JULY 25, 1960

American Machinist / Metalworking Manufacturing

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Special dies in new triple-action press shear smooth edges—see page 100

- **Formula for consistent feeds and speeds,** page 115
- **Who's going to the Chicago Exposition?** page 93
- **How to understand the numbers in numerical control,** page 112

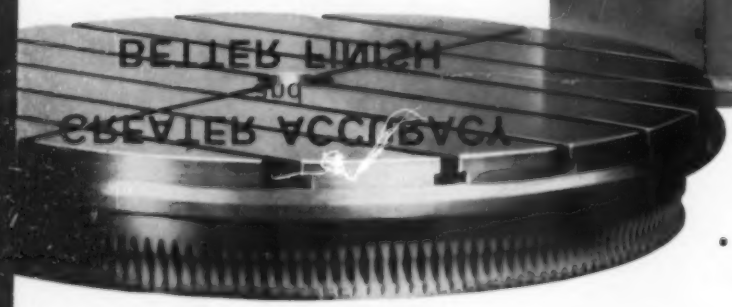
30" HEALD ROTARY

surface grinds

rotary index tables

with

GREATER ACCURACY
and
BETTER FINISH



. . . and up to five times faster, too!

ON this Heald Model 361 30" Plain Rotary Surface Grinder, rotary indexing tables for other high-precision machine tools are ground flat and parallel within .0002", and to a surface finish of 15 micro-inches or better. Cast iron tables from 10 to 30 inches in diameter are easily handled, as well as a variety of miscellaneous parts.

Although high production was not a requirement, this Rotary enabled parts to be finished up to *five times faster* while obtaining greater accuracy and better finish than could be obtained with previous methods.

An adjustable wheel dresser built into the wheel-guard permits truing the wheel without resetting the wheelslide or moving the table. And a demagnetizing switch facilitates setup and unloading.

Heald offers a complete line of high-precision rotary surface grinding machines with chuck sizes from 6 to 30 inches and either manual or automatic reciprocation. Ask your Heald engineer for complete details, or send for a copy of Bulletin 2-361-1 Issue 2.

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THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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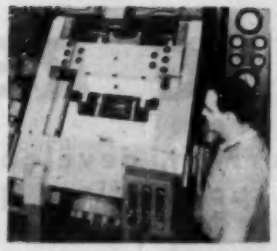
Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • Milwaukee • New York • Philadelphia • Syracuse

HEALD ®

CIRCLE 151 READER SERVICE CARD

Cover:
New triple-action HPM hydraulic press with Hydro-Cam dies shears with smooth edges. See page 98.



American Machinist / *Metalworking Manufacturing*

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METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

New Kind of Bedways

Wearing surfaces on the ways of the new Bullard horizontal boring mill are precision-ground stock—actually strips of bandsaw-grade steel 0.040 in. thick and plated with 0.0015 in. of hard chrome. The strips fit into dovetail slots planed in the surface of the machine bed, and are locked into position with a copper-alloy binder strip. The copper is rolled into place between the two parallel wear strips.

If the ways later have to be replaced, the copper binder can be pulled, and the wear strips lifted out. Satisfactory field reassembly can be made by peening the binder strip into place with a soft hammer.

Credit for this original approach to machine ways is shared by E P Bullard, III, president, and his son, E P Bullard, IV, project engineer on the new machine. In answer to AM/MM's query as to who was responsible, a company spokesman said that "the two Eds dreamed it up between them."

Transfer Machine for Wrenches

First major transfer machine built around internal and surface broaching (and one of few in the country assigned to tool production) is installed at W H Williams & Co, Buffalo, to machine 500 adjustable-wrench handles/hr. Close tolerances on machining make it possible to assemble adjustable jaws to the handle (which includes the fixed jaw) without hand fitting. Wrenches are carried four to a pallet on a closed-circuit pallet conveyor.

Out of 28 stations, 14 are machining—one at the end is for staking. Loading and unloading are at the same station. Operations include drilling, milling, and reaming, to produce all contours on the fixed jaw and inside the head. Surface broaching produces inside jaw contours; internal broaching creates openings for the adjusting worm in the handle.

At two stations the pallets are tilted to an angle to allow internal broaching. Wrenches in 6-, 8-, 10-, and 12-in. sizes are produced; handled on the pallets interchangeably. The transfer machine was designed and built by Colonial Broach & Machine Co, Detroit.

Tape Turret Lathe

Jones and Lamson's tape controlled turret lathe, to be exhibited at the forthcoming Machine Tool Exposition, has a J & L control that costs $5000 less than it would if the company had followed customers' recommendations blindly. Reason: Simultaneous motions of more than one turret are not included, though they can be if the customer wants them.

Analysis of 100 random turret-lathe jobs proved that only five of them showed any advantage if simultaneous motion was available; and the savings in cycle time were only 5-10%. Thus, on 100 jobs, the average advantage for simultaneous control was ¼% — and balanced against a cost of $5000 it seemed pointless. See p 104.

FORMING

Gas Tames Explosive Forming

An oxygen-hydrogen mixture of 8:1 (by weight) may be much better for some kinds of explosive forming than standard liquid or solid explosives. According to John McCallum, Battelle Memorial Institute, Columbus, Ohio, a gas explosion has smoother action and is not as likely to crack low-density materials.

Standard explosives create millions of pounds of pressure in microseconds, and they create reflected shock waves that may double the intended impact, which can damage the work. But gas explosions start off lower and climb gradually to a peak, then taper off. The contrast is something like that between a ping and efficient combustion in a gasoline engine.

Source of the explosive gas mixture is an experimental electrolytic cell that produces the fuel for 10-30¢ per 100 cu ft, depending on power costs. The same gases can be applied for welding or cutting, with flame temperatures above 2000 C.

Safer Die Casting

Two-hand control is now required of die-casting-machine operators at Newton-New Haven Co, West Haven, Conn. This prevents the operator from getting a hand caught in the sliding bolster when it moves forward. Thus the operator can strip a casting with complete safety.

The safety device is a toothed bar, pivoted at the stationary platen, and with its other end free to move up and down. An adjustable stop block on the toothed bar falls in front of the movable platen to make it inoperative.

One hand must lift the stop block by pushing a lever connected to the toothed bar through linkage, and the other must simultaneously press an electrical start button. Switch and stop block are interlocked through a precision switch in the stop block.

HEAT TREATING

Gas Alloys Coiled Steel

A simple mechanical idea has produced a major breakthrough in steel chemistry—because it has far-reaching effects. To speed up furnace annealing, Lee Wilson Engineering Co, Cleveland, wound Nylon string between coil layers of strip steel. This provides air space that speeds up heating, allows more uniform penetration of the annealing gas, and cuts some annealing cycles from a week down to 18 hr.

Now it appears that changes in the chemistry of coiled strip can be made

by varying time, temperature, and composition of the annealing gas. Without reducing the metal to molten steel, it is possible to add or remove carbon, nitrogen, or other alloying elements during the furnace operation. According to F H Sherman at Dominion Foundries and Steel, Ltd, Hamilton, Ont, the process will speed delivery, improve steel quality, and make possible special grades of steel.

INSPECTION

Trend to Gaging Stations

Complete gaging facilities in a portable cabinet—air gages, fixtures, and masters that cover setup and production checking—save scrap and reduce inventory and assembly problems. Cessna Aircraft's Industrial Products Div has been using them at its hydraulic-equipment plant in Hutchinson, Kansas, and is expanding the idea during a 100% increase in production facilities. This is in spite of the fact that a gaging station may cost from 10 to 100% as much as machine investment.

The station idea, originated by Sheffield Corp, Dayton, Ohio, keeps a complete gaging facility available in storage, from where it can be rolled to any of a number of machines when the run is changed and a new setup is being made, or when spot checking is required.

Rapid-Cycle Temperature Chamber

A portable temperature test chamber built by Delta Design, Inc, San Diego, Calif, is capable of completing a hot-cold cycle within the –100 F to +500 F range in slightly less than 10 minutes, thereby substantially reducing the time required for such environmental testing.

Temperature changes of up to 500 F can be accomplished in less than five minutes, and temperature stability throughout the entire temperature range is ±0.5 F.

Cooled by liquid CO_2, the unit provides a 10x7x7-in. test volume and has a window drawer to enable the operator to visually observe the specimen throughout the test. An advanced circuit design minimizes drift caused by line voltage variations on prolonged runs.

Electronic Batch Sampling

Aircraft rivets are batch-sampled in a third the usual time at Boeing by an electronic computer gage that determines individual deviations from standard, then figures deviation for a whole batch. A fixture holds a rivet so a sensing head can measure protrusion of the rivet head. First a master rivet is inserted in the fixture, and the gaging head is set. Then a batch of 50 rivets is inserted, one at a time, for the sensing head to contact. A protrusion-measuring stylus is attached to the movable core of an electro-mechanical transducer, which feeds back a signal to the computer if the sample rivet head is otherwise than exactly the same as the master—within 0.0001 in. Individual readings can be seen on a dial; deviation for the sample batch is computed automatically.

WELDING

Wobble Head Welds Rings

In-between sizes of filler necks in fuel tanks, and other such ring jobs, are handled by a new kind of welding head. The developer, Precision Welder & Flexopress Corp, Cincinnati, says the welder covers the range of sizes too large for projection welding (over 2½ in.), and too small for wheel-type seam welder (under 6 in.). Nominal range of ring work for the machine is ¾ to 6 in. in diameter.

The unit has a circular cup-type electrode that runs on an adjustable eccentric drive, with the cup slightly larger than the diameter to be welded. It is adjusted to tilt so it works on edge, touching the work with rolling-point contact.

ASSEMBLY

Wire Bundles in Fiberglass

Electrical wiring for aircraft is safer, lighter, and more serviceable when bound into molded cable, as developed by Chance Vought, instead of old-style harness. Bundles of 40 wires or more are surrounded by resin-impregnated glass cloth in a mold; when the cable cures it is hard, strong, and non-flexible; which simplifies installation, too.

Cost is little more than conventional harnessing, and field repairs can be made by picking up spare wires or adding external wires until a replacement cable can be installed. Temperature tolerance is at least 300 F, and the cable provides more mechanical protection for wires than anything except metal conduit.

FINISHING

Plata-Seltzer

The chrome-plater's most pressing headache—mist and spray over the plating tank—may soon succumb to an effervescent tablet called Zero Mist. The presumably pleasant-tasting tablet, a development of Udylite Corp, fizzes in the tank and produces a surface layer of foam that holds down mist.

Public health laws in England and the Netherlands now specify the material for chrome-plating tanks without ventilating systems. Although the material dissolves, it does not break down chemically, even in hot chromic acid; and it has no adverse effect on plating action. By preventing mist that would normally be lost in ventilating systems, it may save hundreds of thousands of dollars in vaporized chromic acid.

MATERIALS HANDLING

Flying Freight

Two recent Air Force developments in air-freight handling may contrib-

THE OUTLOOK

Steel production, though not expected to rise greatly in August, should climb sharply thereafter to supply the auto industry, which has scheduled the all-time production high for October. Major appliances are making a comeback after a very rough first half. Electrical machinery builders report good business, with industrial equipment the strongest item. *See page 87.*

COMING IN AM/MM

The ABC's of Numerical Control

A timely Special Report for those who will encounter tape control for the first time at the Machine Tool Exposition in September

ute to future high-speed freighting on a commercial scale:

● One is a modular aluminum crate, primarily designed to hold airframe components, constructed of lightweight aluminum channels that are reusable. The crates, which are adaptable to other kinds of cargo, make considerable space and weight reductions at no loss in strength.

● The other is an expansible tilt-bed trailer with a split axle that compresses to 98 in. wide for air transport, and extends to 120 in. wide for use on the ground. Weight is 6500 lb, carrying capacity is 8 tons. This is believed the first successful application of the split-axle design in a tilt-bed trailer, where longitudinal members act as torsion bars for the running gear.

MATERIALS & COMPONENTS

Spherical Graded Powders

Powdered metals with particles of spherical shape and all of a size within 98% have been announced by Linde's Crystal Products Department. Metals available now are copper, aluminum, nickel, 316 stainless, tungsten, and nichrome. Particle sizes range in grades from 20 to 150 microns.

Production is in inert atmosphere, so voids, cavities, and inclusions are claimed to be eliminated. Advantages suggested by Linde include better quality of sintered products, less hazard in handling reactive powders, and better flow into molds when as little as 10-20% of the mold charge is spherical graded powder.

Powder particles may include surface oxidation, but complete handling in inert atmosphere is possible if surfaces must be pure. Number of non-spherical particles included is under 2%.

Tiny Noise Soakers

Vibration - dampening machine mounts have spread to smaller sizes designed for office equipment, air conditioners, and other motorized plant devices that contribute to the general noise level. A new line by Felters Co includes level-adjusting screws and Unisorb (felt) insulation, graded for light equipment. Bases are circular, and can be substituted for standard office-furniture feet.

Along with the announcement, Felters says these isolators cut 85% of the vibration from machines such as big presses, and suggests, tongue-in-cheek, that the new line installed under the press foreman's desk will cut 85% of the remaining 15% from the press to keep his correspondence, at least, isolated from the general din.

MANUFACTURING CONTROL

Common-Parts Machine Tools

Building-block construction for 132 combinations in No. 2 millers and 144 combinations in surface grinders cuts delivery time, inventory, and costs for Brown & Sharpe. This is a second-level "building-block" application, where machine components are treated as units pulled from stock in any required combination to build up a machine tool for a specific purpose.

The company expects to keep a well-balanced inventory of economical proportions that still provides quick customer service—saving as much as five weeks delivery time in some cases. The machine tools have been redesigned to use as many common parts as possible, to reduce movements and operations during manufacture, and to simplify assembly. The new method includes a production line on which main subassemblies are constructed.

Customers Designed It

Van Norman designed its new inner-groove grinder for miniature bearings strictly by customer demand—on advice from the eight manufacturers who produce miniature ball bearings. It is the first grinder claimed to be designed specifically for the inner ball groove, and it is different from standard design.

Long-range planning required a year of consulting with customers and of research. The result is a machine that has all the features the customers want. Introduction will be at the forthcoming Machine Tool Exposition in Chicago; full details of the research program and of the machine itself will be carried in our August 8 issue.

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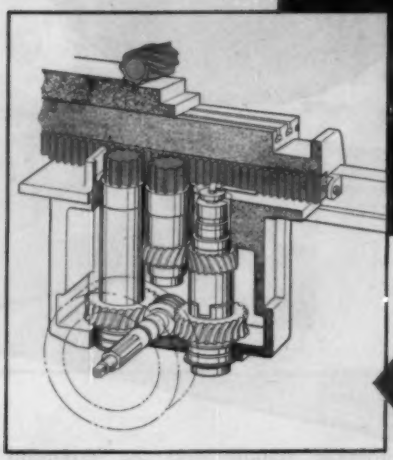

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CINCINNATI HyPowermatics are making unusual production records in shops everywhere, through Hydramech and many other outstanding advantages. You'll find more details on the two pages following, and complete information in catalogs M-1909-3 and M-2020-2. May we send you copies? **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

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- infinitely variable table feed rates, ¼" to 150" per minute
- a wide range of 16 spindle speeds
- only three gear contacts in spindle drive
- Hydramech table drive, assuring uniformly smooth cutting action
- built-in backlash eliminator, for conventional and climb milling operations
- automatic spindle stop, an important safety feature
- automatic, two-way table cycles
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BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES

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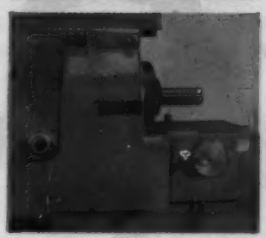
AUTOMATIC QUILL RETRACTION *extends cutter life, cuts down-time for cutter changes.*

AUTOMATIC VARIABLE FEED *automatically controls the feed rate during the cut . . . a definite aid to economical production.*



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No. of Sizes	Types	Table Traverse	Feed hp	Spindle hp
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50	Duplex	2—14 ft.	3—5	5—50
50	Plain Rise and Fall	2—14 ft.	3—5	5—50
50	Duplex Rise and Fall	2—14 ft.	3—5	5—50
50	Plain Tracer Controlled	2—14 ft.	3—5	5—50
50	Duplex Tracer Controlled	2—14 ft.	3—5	5—50

Write for Catalogs: M-1909-3 for 300, 400 and 500 Series HyPowermatics; M-2020-2 for 100 and 200 Series HyPowermatics.

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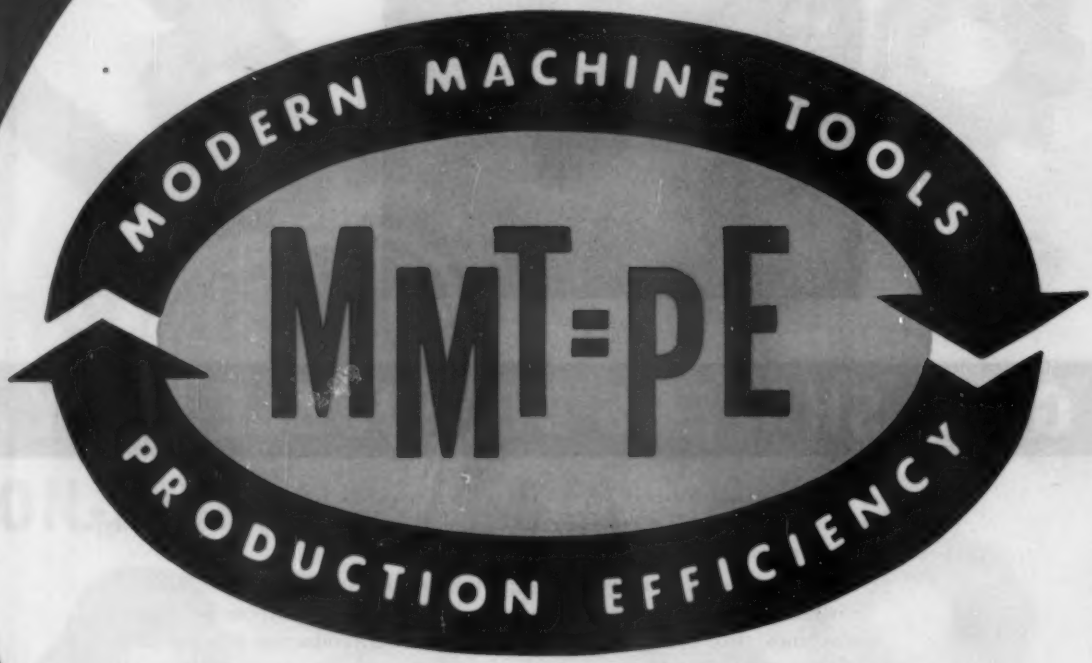

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NEW METHODS— see the *new* LANHYROL Thread Rolling Machine in the unique roll-straightening operation—duplicating the one now producing 4500 parts per hour in the plant of a large automobile manufacturer.

NEW IDEAS— Let LANDIS Engineers tell you about the untapped possibilities for production and profit with the *only* complete line of Thread Rolling Equipment—Machines, Attachments, and Heads!

and-IN ADDITION— there will be Thread Cutting and Tapping equipment in operation producing threads in both conventional and unusual applications. And—the complete line of the World's Largest Selection of Threading Tools will be displayed for your inspection.

DON'T MISS THIS wonderful opportunity at Booth 432 for a personal give-and-take discussion of your threading operations. Trained Threading Engineers will be available throughout the Exposition to analyze your problems and make suggestions for improving quality, increasing production, cutting costs.

583C

only the allNEW LANDIS centerless grinder has all these features...

be sure to see **LANDIS** *at the MTE*

...the years ahead line of precision grinders

Landis No. 12R centerless grinder for automatic grinding of automotive valves.

allNEW **bed**—no hydraulic oil or open drains in bed . . . maintains better machine alignment

allNEW **wheelfeed**—with turning handwheel during grinding feed for easier setup and operation

allNEW **truform dresser**—with both slides on preloaded balls for exact dressing and profiling of grinding and regulating wheels

allNEW **rotary diamond tool and crush dressing** —available for profiling grinding wheels with Truform dresser

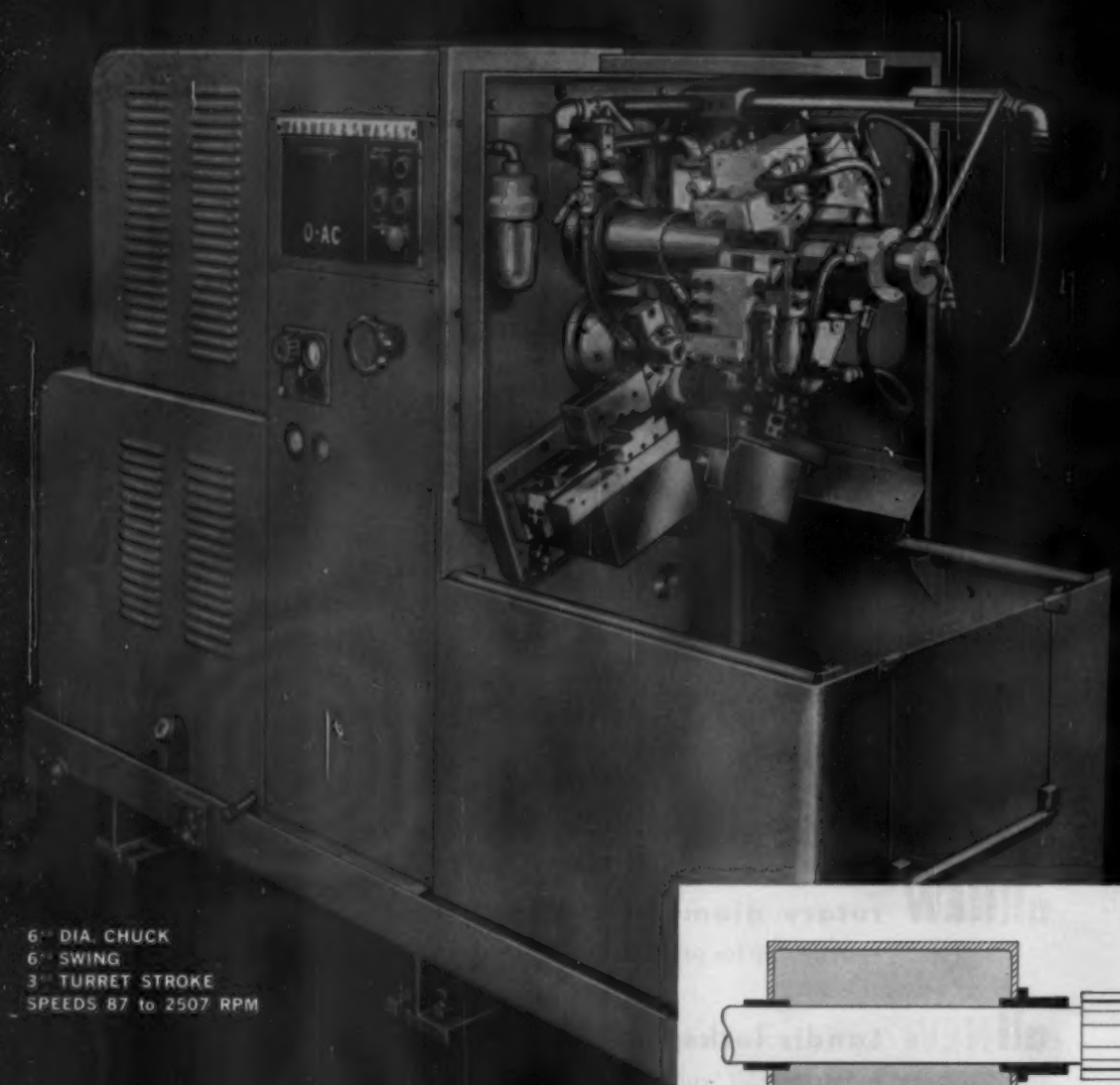
allNEW **Landis lockspeed regulating wheel drive** —for rounder workpieces and faster grinding cycles

LANDIS

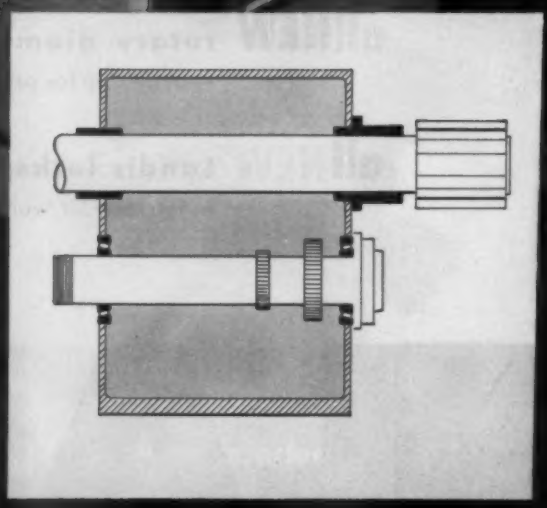
world leader in precision grinders

Landis Tool Company, Waynesboro, Pennsylvania

NOW YOU CAN AUTOMATE PRODUCTION



6" DIA. CHUCK
6" SWING
3" TURRET STROKE
SPEEDS 87 to 2507 RPM



Spindle rise has been practically eliminated in the O-AC by placing the spindle and turret bearings in the same housing where they are subjected to exactly the same temperature, and continually lubricated with clean, filtered oil.

OF SMALL PRECISION PARTS with the New Warner & Swasey O-AC Single Spindle Chucking Automatic

Warner & Swasey's newest addition to its proven line of Single Spindle Chucking Automatics — the O-AC — is specifically designed to automate the production of small precision parts in all lot sizes — even as few as 30 or 40 pieces.

SMALL LOTS are profitable on the O-AC because it sets up fast and can be changed from job to job quickly and easily. There are no cams to design, change or store. The tooling area is uncluttered, easy to get to for faster cutter setting and adjustments.

PRECISION work piece tolerances and fine finishes on a repetitive piece-after-piece automatic basis are routine for this new single spindle chucker. Because of its unique overhead turret construction, only the O-AC can assure this high degree of production accuracy.

VERSATILE PERFORMANCE results from the O-AC's unique tool slide actions. A wide range of work — from ordinary small castings to complicated missile components — is efficiently handled, usually with low-cost standard tooling.

Your Warner & Swasey Field Engineer has the complete facts on the new O-AC ready for you. Or write us direct, Warner & Swasey Co., Cleveland 3, Ohio.

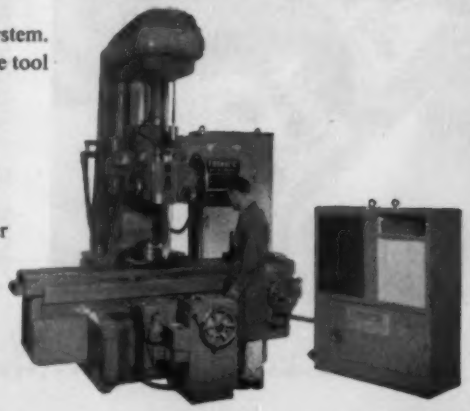
All automatic functions are rapidly set up by the simple placement of trip blocks and switch operating screws. All automatic functions can be individually hand controlled during setup and switched to "automatic" or back to "hand" at any time with a single control switch.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

PRECISION BORING: Control gains a Third Dimension!

Now Fosdick adds Numerical Depth Control to its unique positioning system. Another loophole for error in precision boring has disappeared. Watch the tool drive smoothly to depth, boring a hole with finer finish, precise in depth and location. Watch the tool advance and retract quickly, saving time. *Tape or dial any depth. Absolutely no stops to preset.*

See how this control signals every tool change and compensates for tools of random length. It was planned when the Fosmatic precision boring machines were designed, so that it fits and takes no extra space. Consider what this new dimension in control means to your critical production jobs. Write for catalog PB-W.



FOSDICK THE FOSDICK MACHINE TOOL COMPANY
Cincinnati 23, Ohio

Eight of twelve Landis Abrasive No. 3½ surface grinders at Glennie Industries, Inc., a precision tool and die manufacturer in Romulus, Michigan.

GLENNIE INDUSTRIES REPORTS:

"Faster than any other hand operated grinder" for grinding punches and dies

Grinding the nose contour of an interchangeable ball type punch to tolerances of ±.0001".

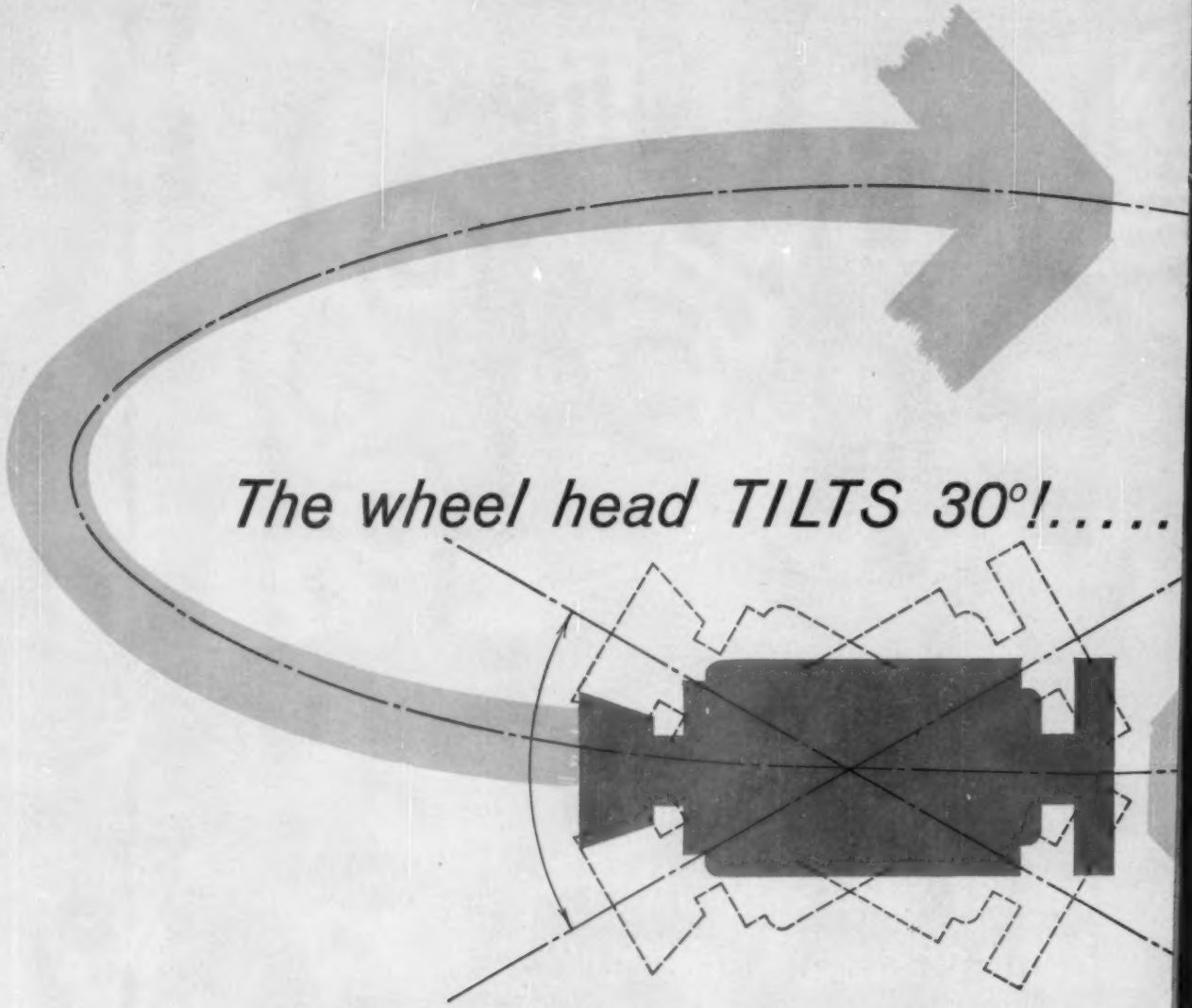
At Glennie Industries, where grinding is the largest operation, Landis Abrasive No. 3½ surface grinders maintain high standards of precision and production. For similar results in your shop, request a call by a Landis Abrasive surface grinder representative.

LANDIS

ABRASIVE

precision surface grinders

Landis Tool Company, Waynesboro, Penna.



The NEW NORTON No. 200 Cutter and Tool Grinder makes setups simpler... easier... quicker!

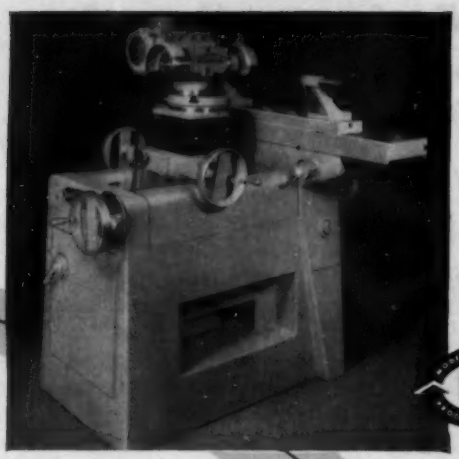
Tool room men can tell you that grinding a taper reamer is one of their toughest jobs. But now they're discovering that it and other tough tool grinding jobs are a "snap" with the new Norton No. 200. Because:

You can tilt the wheel head up to 15° above or below horizontal — and swivel it through a full orbit of 360°.

And the table has a very rugged, extremely accurate guide bar, which assures precision in tracking, during the most difficult grinding jobs.

All this means no more time-wasting "cut and try" tactics . . . no more wrestling with tricky setups . . . a wheel head scale provides quick direct readings of clearance angles . . . for practically all grinding on centers, the

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



MMT-PE

ORBITS 360°!

VISIT BOOTH #651
Machine Tool Exposition • 1960
INTERNATIONAL AMPITHEATRE
Chicago — September 6-16

tooth rest can be kept on the center-line of the cutter, eliminating time losses from additional settings . . . the table design enables use of gage blocks for quick taper grinding setups and fast return of table to straight setting . . . greater wheel head capacity through eccentric mounting simplifies approach to many special jobs.

In addition:

The No. 200's extremely solid grinding action brings you excellent finish on tool cutting edges, with resulting benefits in tool life and performance. That's because the No. 200 is a wheel slide type machine, where grinding is always within the area of the rigid base, with no instability due to work overhang. Other advanced features include: quick-change two-speed wheel drive; centrally located column controls, wheel slide dials readable from any position.

Your Norton Man, a trained grinding engineer, will be glad to show you how the new Norton No. 200 cutter and tool grinder can help you modernize and economize in your plant. For catalog #1371, write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *District Offices:* Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

NORTON
MACHINE TOOLS
75 years of . . . Making better products
. . . to make your products better

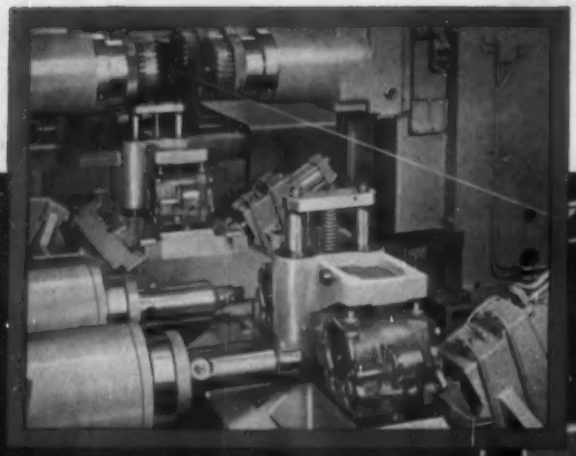
MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines • Gear Induction Hardeners

CIRCLE 168 READER SERVICE CARD

CIRCLE 169 READER SERVICE CARD ►

Cross Introduces Automation for High Precision Boring and Facing

Many Unusual Features in New Transfer-matic for Machining Transmission Cases



Finish boring the front and rear main bores with one bar to assure concentricity.

Operations include boring the main shaft, counter shaft, reverse idler, and two shifter rod bores and precision facing both ends.

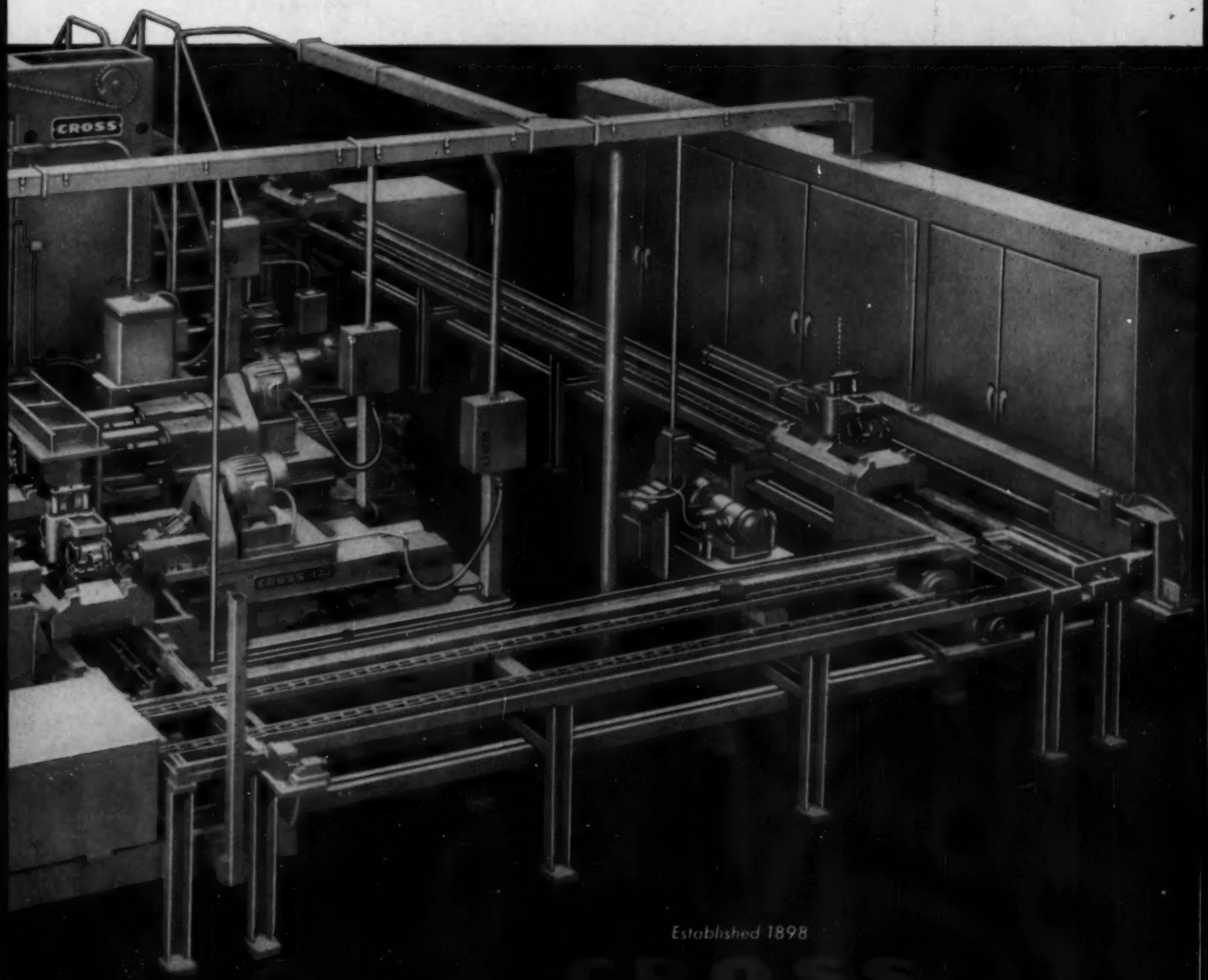
Another Automation First by Cross

An unusual new Transfer-matic which applies the production economies of automation to high precision finishing has been designed by Cross. It bores and faces transmission cases at a rated capacity of 140 parts per hour despite the rigid accuracy.

Some bore sizes are held to tolerances of plus or minus 0.00035 inch and chordal dimensions between three holes are held within plus or minus 0.001 inch. Squareness between the ends and bores is maintained to 0.0005 inch. Surface finish specifications are 56-110 micro-inches, rms.

A number of special features have been developed to assure this high precision. Center bases and wings are integral to obtain the rigidity necessary for maintaining precision alignment. Pallet locating is designed to assure extreme accuracy from station to station. Strategically placed air jets check the position of the pallets in each station.

A Cross sales engineer will be glad to explain details of this unusual Transfer-matic and other Cross innovations.



Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

What's the latest with LAPOINTE ?

It's this fully automatic, numerically controlled

DRILLING and BORING MACHINE

. . . and you'll see it for the first time at the Exposition of the N.M.T.B.A., International Amphitheatre, Chicago, September 6-16, 1960

MMT-PE

Space No. 1229
Donovan Hall

Lapointe-developed and built for precision drilling, reaming, or boring any hole pattern up to a maximum 60" bolt circle . . . with indexing accuracy of the table within 6 seconds of arc . . . and designed to substantially reduce production costs on short run parts in your plant. Saves in set-up time. Good for runs of 1 to 500 parts.

Choice of operating methods: *fully automatic* through a two-axis punched tape numerical control (controls angular positioning of the rotary table and lateral positioning of the spindle on the cross rail) • *manual numeric* by dialing in information • *fully automatic* through electromechanical means • *semi-automatic* through push-button controls.

See this remarkable new machine at the Show. Write for detailed description.

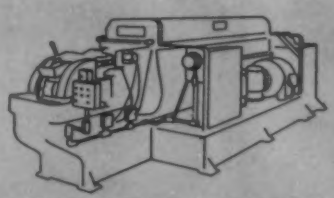
THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

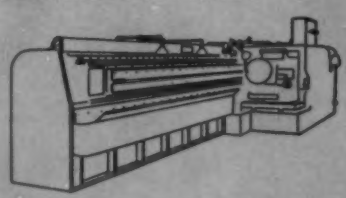
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.

60" STROKE HORIZONTAL, ELECTRIC



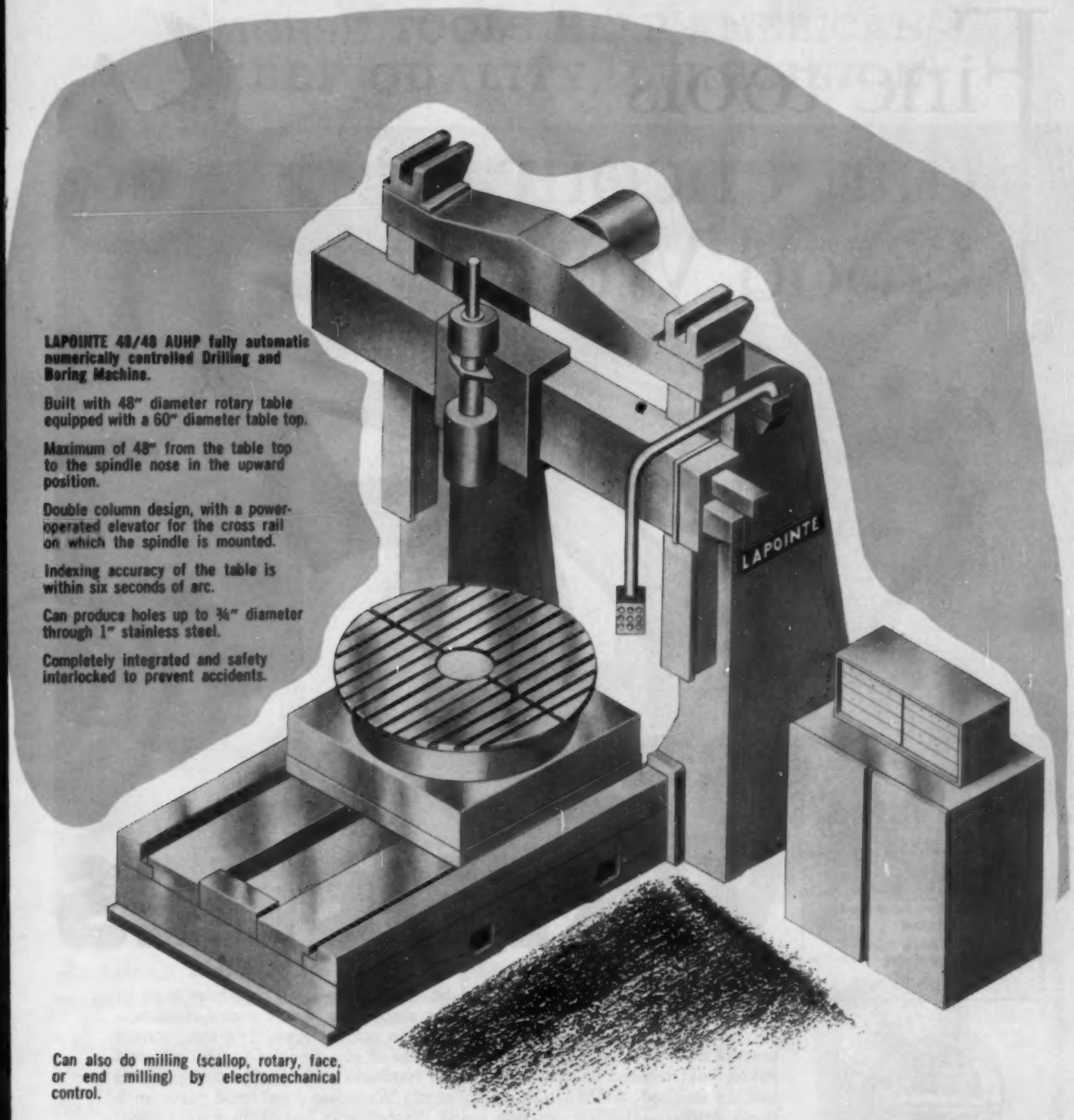
CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

◀ CIRCLE 170 READER SERVICE CARD

CIRCLE 171 READER SERVICE CARD



LAPOINTE 48/48 AUHP fully automatic numerically controlled Drilling and Boring Machine.

Built with 48" diameter rotary table equipped with a 60" diameter table top.

Maximum of 48" from the table top to the spindle nose in the upward position.

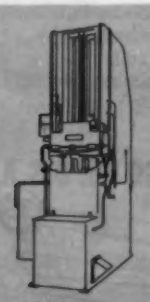
Double column design, with a power-operated elevator for the cross rail on which the spindle is mounted.

Indexing accuracy of the table is within six seconds of arc.

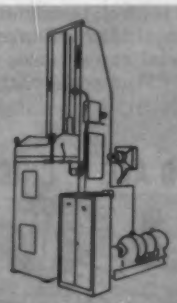
Can produce holes up to ¾" diameter through 1" stainless steel.

Completely integrated and safety interlocked to prevent accidents.

Can also do milling (scallop, rotary, face, or end milling) by electromechanical control.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC

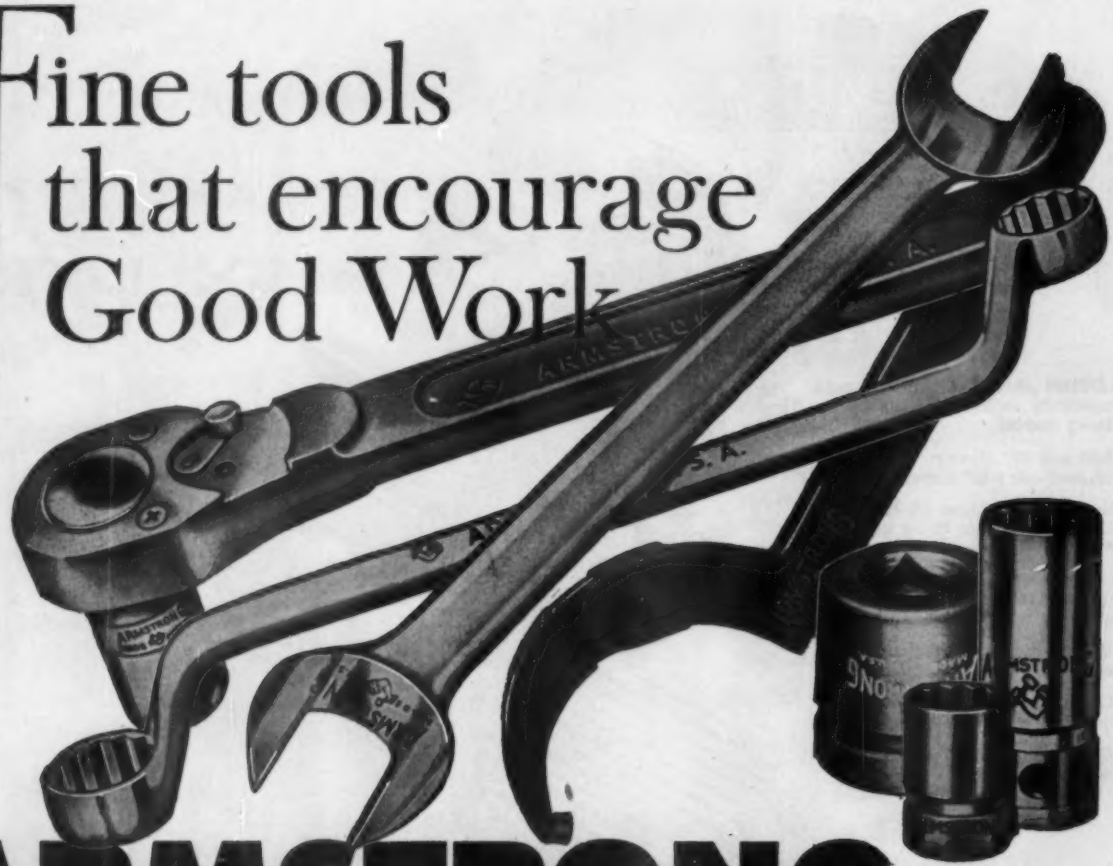
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

Fine tools that encourage Good Work



ARMSTRONG WRENCHES

SEE US AT
BOOTH 238
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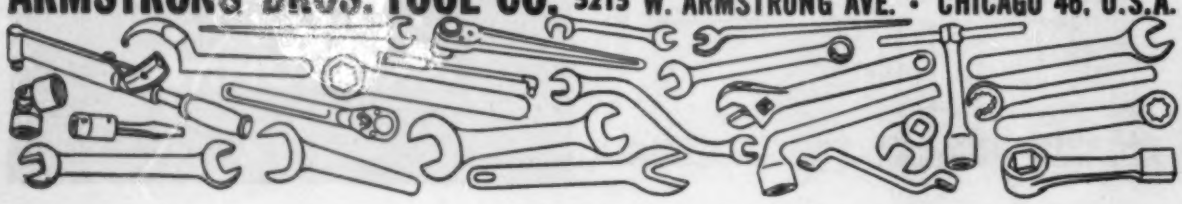
INDUSTRIAL DISTRIBUTORS
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

If you don't know your local ARMSTRONG Distributor, we will send you the names of those in your area.

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.



MORSE TOOLS HELP AMERICAN KEEP QUALITY... PRECISION

American Hoist & Derrick Company cuts cost... maintenance with Morse precision tools

For years economy of operation and low maintenance has been an outstanding feature at American.

So it follows they use Morse Tools during manufacture... because it takes top-quality, tough tools to build rugged machines. It takes Morse Cutting Tools... the best known quality tools on the market ... for smoother, faster machining and longer tool life.

For your cutting tool needs, it will pay you to order "Morse". Call your Morse Franchised Distributor today.

Morse means more production... smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality,* there's only one way to get it... *specify Morse.*

MORSE

means "THE MOST" in Cutting Tools

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

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VN

A Division of VAN NORMAN INDUSTRIES, INC.

6 precision spindles by Avey

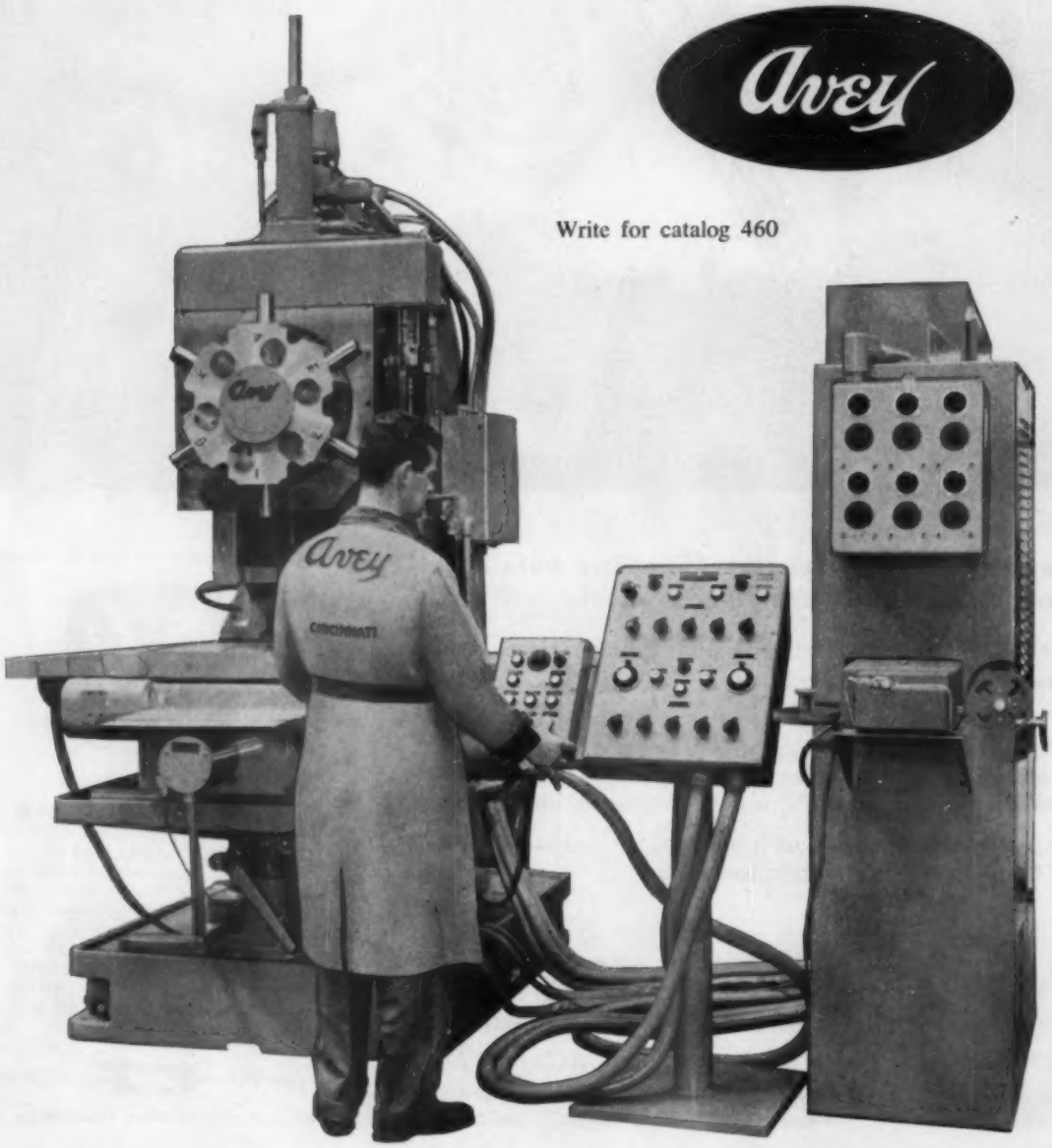
The reliability of the Avey 250 Turret-Dex matches the quality of the thousands of Avey drilling, tapping, and production machines which preceded it. It is available as either an automatic machine or numerically-controlled with rotary or two-axis positioning table. Pre-selected speeds, feeds, rapid advance, and tapping cycles. Automatic depth control for all spindles.

All spindles may be skip indexed. Automatic turret clamping. Positive spindle location. Rigid one-piece spindles, mounted in "O" precision taper roller bearings. Capacity up to 1¼" in steel.

The Avey Turret-Dex makes it more clear than ever that, for your drilling requirements, "Avey makes the right one for Avey makes them all." The Avey Division, Motch & Merryweather Machinery Co., Box 1264, Cincinnati 1, Ohio.

Avey

Write for catalog 460



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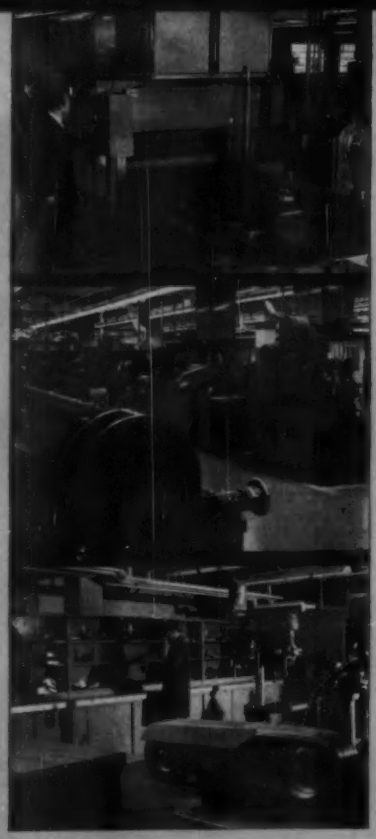
Now! YOUR Lab for better finishes built especially for YOU, it's a perfect place to:

- solve a particular production problem
- determine the advantages of wide-belt sheet polishing
- investigate new off-hand polishing techniques
- train production men
- increase production — lower costs — improve finishes



the men and machines in this building can help you

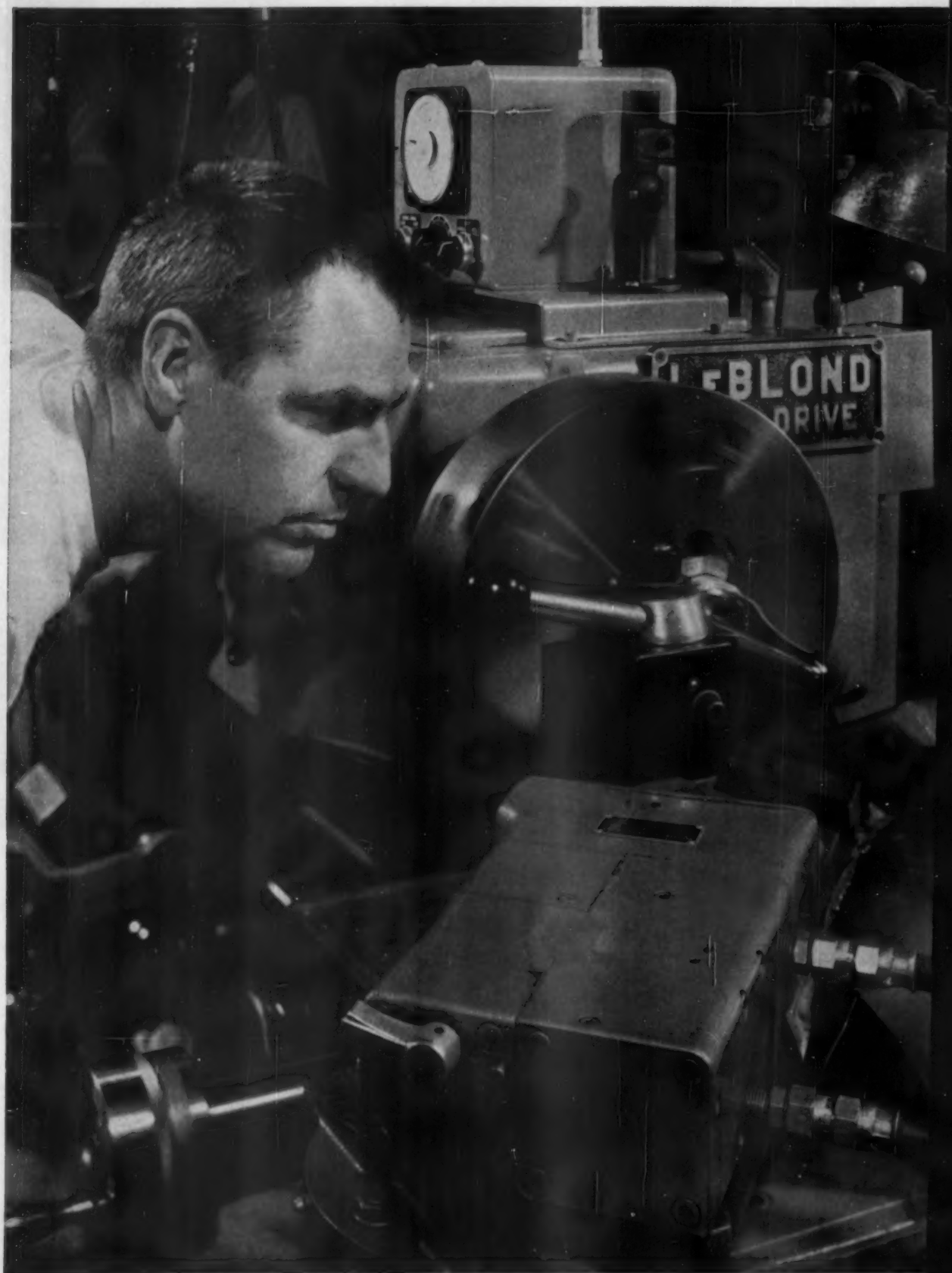
This is "Abrasive Tech" the Product Engineering Department of Behr-Manning Co.; inside are assembled the most modern production equipment and prototypes of the newest machines for every phase of coated abrasive grinding and polishing of every known material.

Inside are "Abrasive Tech" specialists — engineering and production experts whose job is to devote their time, skill and energies to helping you solve your problems. And they know their business. There are also Behr-Manning Machinery Methods Rooms in 16 conveniently located branches to help you in exactly the same way. Write for a detailed brochure of "Abrasive Tech" Product Engineering facilities and a list of the machinery at your service. Dept. AM-/, BEHR-MANNING CO., Troy, N. Y., a Division of Norton Company.

Branches In: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New York, Philadelphia, St. Louis, San Francisco, Seattle.

® BEAR BRAND *Coated Abrasives*

CIRCLE 176 READER SERVICE CARD


BLOND
DRIVE

FINISH:

Reason enough to buy LeBlond

The glass industry is beginning to turn to mold plungers hard-surfaced with Colmonoy 6 to withstand the corrosion of molten glass. At 57-59 Rockwell C hardness, you don't machine such plungers on ordinary lathes—if you can machine them at all.

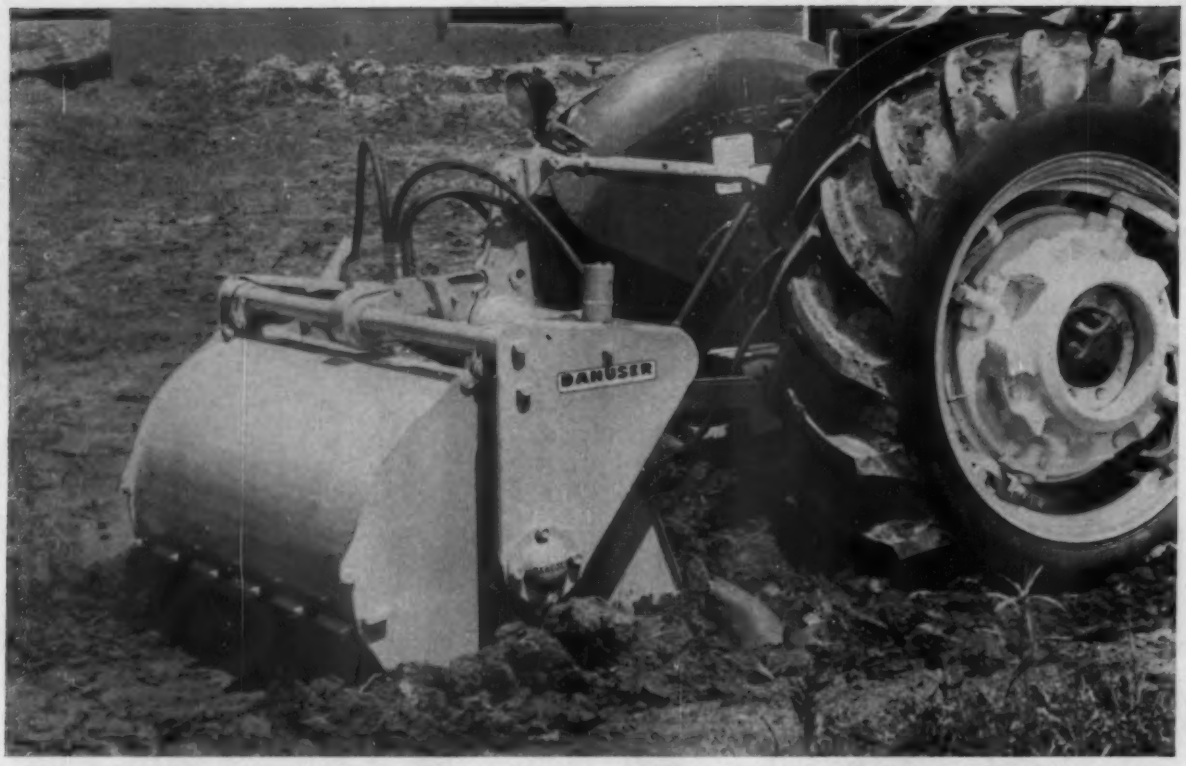
Yet Overmyer Mould Company of Winchester, Ind., turns Colmonoy coated plungers in 3 passes *to a 10 micro-inch finish.* That's more than fine enough to *use as-machined.*

Overmyer does it with 15" LeBlond Dual-Drive Lathes equipped with LeBlond tracers and constant surface speed control. From 1000 rpm at start of cut to 125 rpm at finish the Dual-Drives supply smooth, vibrationless power.

Rock-steadiness for turning rock-hard materials . . . Rigidity without excess weight or size . . . These are strong reasons to buy a lathe. They are reason enough to buy LeBlond.

LeBLOND of Cincinnati

THE R. K. LeBLOND MACHINE TOOL CO.
World's Largest Builder of a Complete Line of Lathes
CINCINNATI 8, OHIO



The versatile Terra Scoop, designed for maximum strength with minimum dead weight. Built by Danuser Machine Company, Fulton, Mo. Weighs only 540 pounds. USS "T-1" Steel is readily flame cut, welded and fabricated by usual shop methods.

Lightweight scoop built **strong and rigid** with USS "T-1" Steel

The big problem in designing the "Terra Scoop," a bucket with over ½-yard capacity for small tractors, was to obtain great strength and rigidity without exceeding size and weight limitations.

The first prototype scoop bulged at the ends and couldn't be used. That's where USS "T-1" Steel entered the picture. With a minimum yield strength of 100,000 psi, ¼-inch plates of "T-1" Steel gave the Terra Scoop all the strength it needed—and more, too—without increasing weight.

Since then, many Terra Scoops have been sold. *Not a single failure has been recorded in any of the end plates*—thanks to the extra yield strength of USS "T-1" Steel. What's more, the high resistance of "T-1" Steel to impact abrasion and corrosion has added years to scoop life.

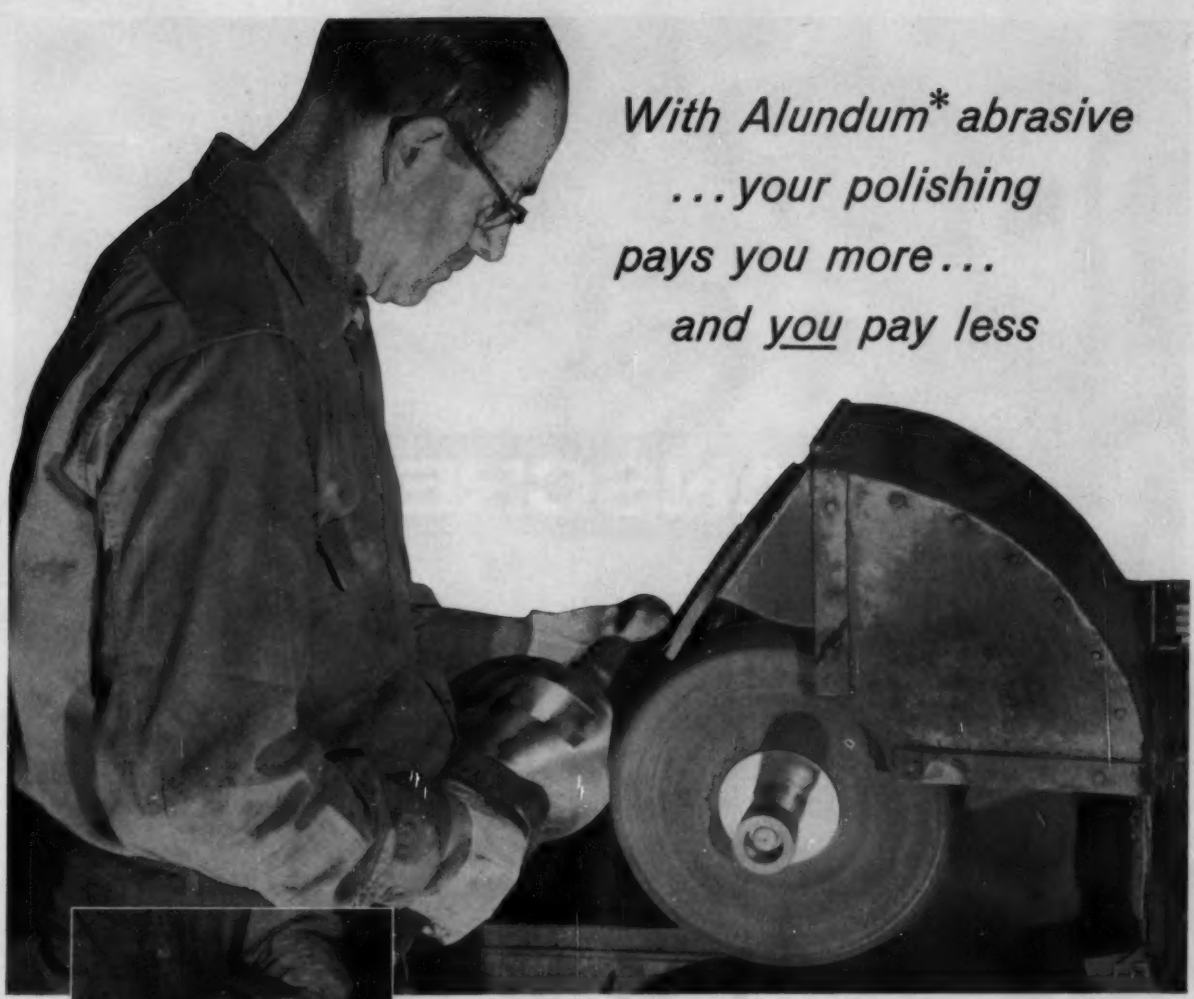
Fabrication advantages. During initial testing, it was established that flame cutting, by which the end plate is made, actually imparts a superior hardness to the edge which functions as a cam in the operating mechanism. This edge has to retain its hardness to prevent peening from hardened rollers with which it comes in contact. Welding and machining were accomplished without difficulty using recommended shop methods.

Free books for designers. If your problem is designing bigger, more rugged equipment, you'll be interested in our booklets on USS "T-1" Constructional Alloy Steel and USS MAN-TEN, COR-TEN and TRI-TEN Brands of High Strength Steel. Write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS, "T-1", MAN-TEN, COR-TEN and TRI-TEN are registered trademarks

This mark tells you a product is made of modern, dependable Steel.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company
United States Steel



With Alundum abrasive ... your polishing pays you more... and you pay less*

A stainless steel floating ball, chief feature of a leading valve manufacturer's product, requires a high polish for its high efficiency. ALUNDUM abrasive is the leading manufacturer's selection for this important polishing job.

Setting up your polishing wheels with ALUNDUM abrasive is easy and profitable. This grain's high capillarity speeds and strengthens the wetting process with glue or cement — making your wheels last longer and polish better.

Where finish is essential to product appeal or product efficiency, Norton ALUNDUM abrasives are the first choice in many plants. For extra long service life the blocky-shaped E_1 ALUNDUM B abrasive in grit sizes 14 to 240 is widely popular. For faster cutting action E_{122} ALUNDUM S abrasive (grit sizes 14 to 90) or E_{188} ALUNDUM R (grit sizes 100 to 240) are preferred.

Uniform grain shapes and sizings of these popular Norton abrasives assure fast cutting action, with no oversize grains to mar the finish, no undersize grains to lag on the job. And their high capillarity provides the easy absorption of glue or cement that means longer lasting, better performing set-up wheels.

The booklet *"Setting Up Metal Polishing Wheels and Belts"* tells you about the various types of ALUNDUM abrasives . . . or their uses when applied to canvas, leather or wooden wheels . . . and the best means of preparing wheels. Ask your Norton Distributor for it. Or write to NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and Distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and foreign countries

NORTON
ABRASIVES

G-383

75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

STANSCREW

Symbol of a new concept

in fastener service

American industry is learning Stanscrew means extra values.

This symbol personifies a trained staff of fastener specialists. Their technical assistance can often help you reduce fastener and assembly costs.

It means extra quick deliveries from complete inventories maintained at three conveniently located plants . . . over 5,000 different types and sizes to assure a broad selection for the great majority of your requirements . . . and, above all else, fasteners of consistently high quality.

Although it first appeared in 1958, the Stanscrew trademark represents a wealth of fastener experience. For it combines the technical skills and specialized facilities of three major manufacturing divisions of Standard Screw Company, each an honored name for more than 80 years. They are:

THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

For fasteners, specify Stanscrew. For other needs of home and industry, Standard Screw divisions also produce:

Moen single-handle faucets • *Hartford textile spindles*
Roosa Master fuel injection pumps • *Chicago tappets*

Each division also provides a complete design and manufacturing service for cold headed and screw machine products.

STANDARD SCREW COMPANY
2701 Washington Boulevard • Bellwood, Illinois

diamonds . . . gold . . . carbide

He is watching the first . . . add a touch of the second . . . to the third

The best cutting tools deserve the best sharpening wheels. The economy and improvement which carbide-tipped tools bring to their cutting jobs are brought to the tools themselves by sharpening with Norton diamond wheels of man-made (SD) diamond.

The cost-cutting, product-improving "Touch of Gold", created by Norton leadership in diamond wheel development, began back in 1930. Norton was first to introduce all three bond types of diamond wheels . . . and produces the largest line.

Today, similar pioneering continues Norton leadership in the application of both mined and man-made diamonds to provide better performance, longer service life and lower grinding cost. Your Norton Man, a trained engineer, and your Norton Distributor will be glad to tell you how these "Touch of Gold" benefits can be brought to your own production. NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

NORTON
ABRASIVES

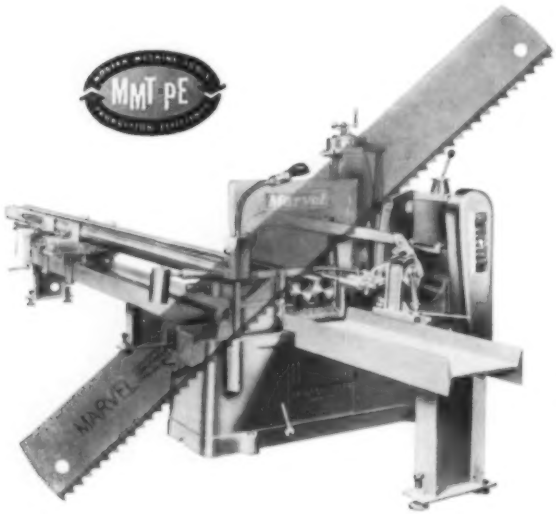
75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

a message to owners of

MARVEL HACK SAW MACHINES

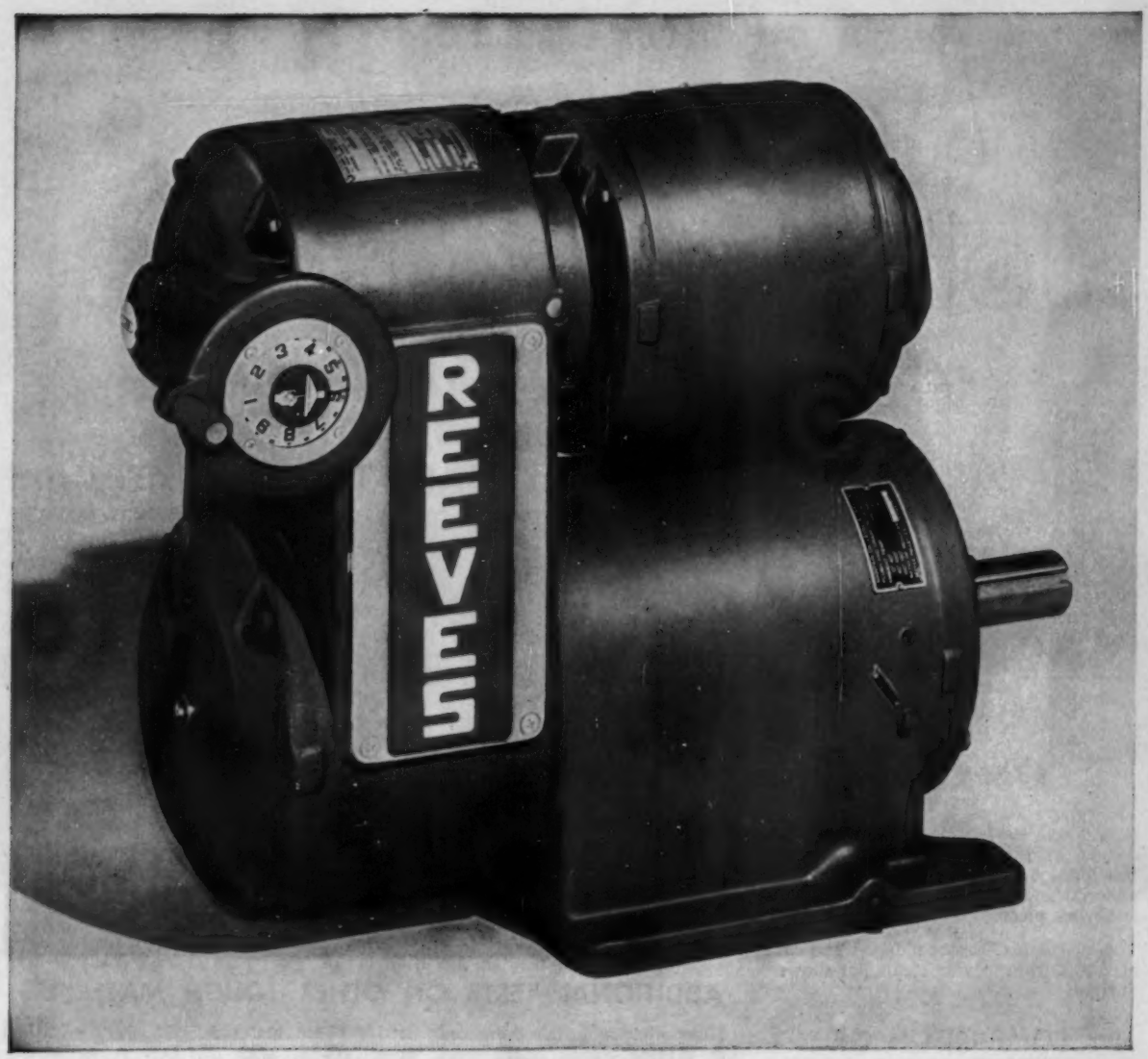
If you are the owner of a MARVEL Hack Saw Machine, check the name on the blades being used in it. If they are not MARVEL Blades, the chances are very good that you are not getting all the cutting-off speed, accuracy, and economy you paid for when you bought a MARVEL Saw. Consider this fact. The hack saw *blade* is the cutting tool that actually does the cutting job. If the machine is expected to deliver its full efficiency, the blade must possess a ruggedness comparable to that of the machine. Isn't it logical, then, that the blades you use be as carefully selected as the machine itself? Here is another fact: The MARVEL High-Speed-Edge Hack Saw Blade was designed specifically to withstand the heavy feed pressures and high cutting speeds your MARVEL Hack Saw can deliver. Only MARVEL UNBREAKABLE Hack Saw Blades can be safely tensioned taut enough to provide the maximum rigidity of the cutting tool necessary for accurate cutting-off; and at the same time, protect both the operator from injury and the machine from damage that so frequently occurs with "breakable" blades.



Why not be certain your MARVEL saw is delivering the high performance you had originally purchased, by using the only blade capable of utilizing the power and accuracy built into the machine? MARVEL Hack Saw Machines and MARVEL High-Speed-Edge Blades are an unbeatable combination. MARVEL High-Speed-Edge Hack Saw Blades are stocked and sold by leading Industrial Distributors everywhere.

ARMSTRONG-BLUM MFG. CO.
5700 Bloomingdale Avenue • Chicago, Illinois

MARVEL Metal Cutting SAWS
Better Machines-Better Blades



REEVES Vari-Speed Motodrive

packed with new flexibility . . . broader production use

Now available in this compact design, Reeves Vari-Speed Motodrives deliver 2:1 through 10:1 speed variation, 1.8 through 4660 rpm . . . ¼ to 20 hp.

The infinitely variable output speeds meet almost every production need.

You can get these drives with output shaft on same or opposite side of the motor; vertical, 45°, horizontal or trunnion models; no reducer, and single, double or triple stage reductions . . . hundreds of space saving assemblies. Reeves provides a full range of modifications, accessories, and manual, remote or automatic controls. G-1639

Write today for complete data on sizes 100-500 (1/4-20 hp) and sizes 8000 (25-40 hp)

REEVES PULLEY COMPANY
Division of RELIANCE ELECTRIC AND ENGINEERING CO.
COLUMBUS, INDIANA
In Canada: Reeves Drives • Toronto • Montreal

R MASTER REEVES

Precision Ground

Atrax SOLID CARBIDE TOOLS AND BURS

Job Applications

New cutting efficiency has been designed and engineered into a new line of Atrax Stub Routers. These are solid carbide standard, off-the-shelf tools available in nine sizes from 1/16" to ½" diameter and 1" to 1½" in length.

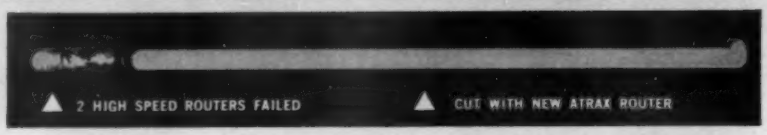
Precision ground, the Series 1546 Router has a single, straight flute, straight shank and right hand cut. Tolerances are kept to +.000 −.003.

NEW ATRAX STUB ROUTER PLUNGES, SLOTS, FORMS EXTREMELY HARD-TO-CUT MATERIALS

SHOP TESTS PROVE SUPERIORITY

This photo shows the second of two high speed steel routers failing to cut copper clad Fiberglas printed circuit board. Note the burning of tool and material and the jagged hole at left in test work piece.

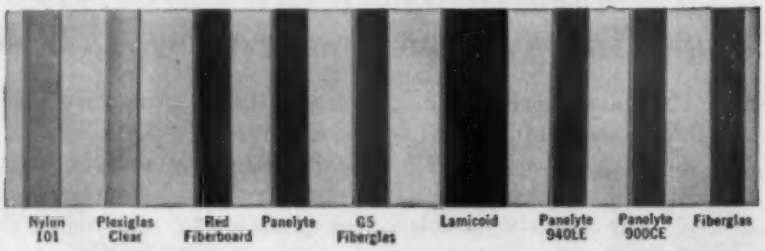
The new Atrax Router plunged and cut at 20,000 rpm leaving clean slot shown at right.



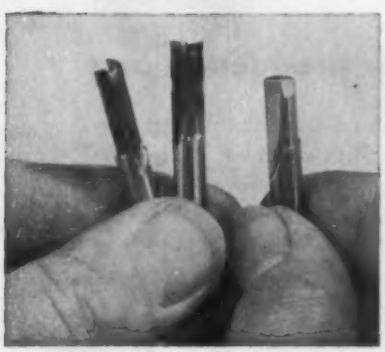
ADDITIONAL TESTS ON OTHER TOUGH MATERIALS

Nine other materials commonly used in printed circuit board work were tested. All were cut quickly and efficiently with the new Atrax Router.

These materials can also be drilled readily with the new Atrax Micro-Drills available in wire sizes from #1 to#80.



COMPARISON OF TEST TOOLS



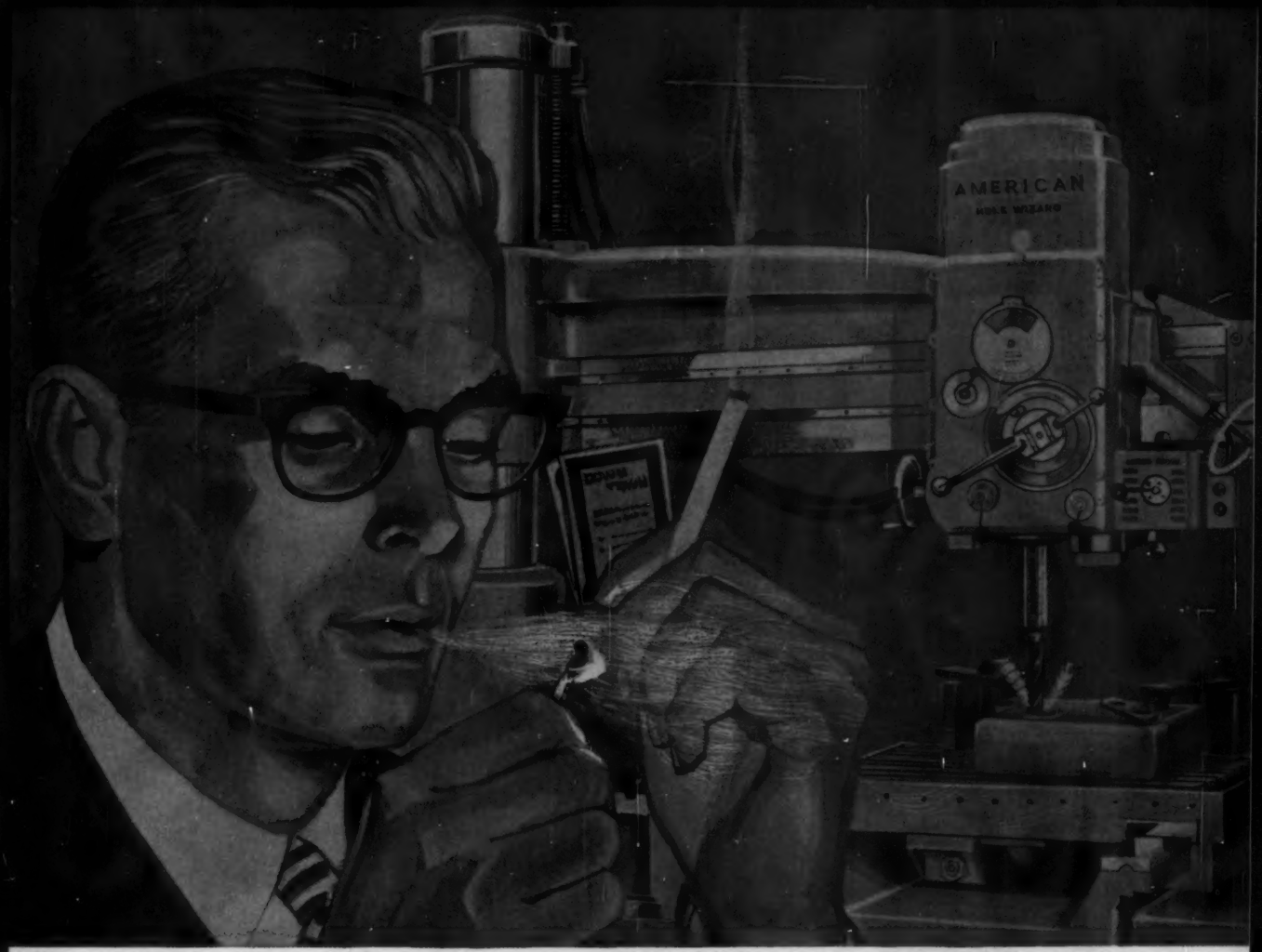
Two high speed routers on left were unserviceable after a few seconds. Atrax Solid Carbide Router showed no wear land and left clean slot with no bur on either side of printed circuit board.

SOLID CARBIDE TOOLING RESULTS

in savings in production time and in experimental prototype circuit board work. Many of the new extremely tough materials can be worked faster, easier with Atrax Routers, Drills and End Mills. The Atrax Company will be pleased to furnish information on speeds and feeds recommended for best results.

Send for 148 Page "Standard Reference" on Solid Carbide Tools.

THE ATRAX COMPANY
240 DAY STREET
NEWINGTON, 11, CONN.



A Little Puff of Air Is All It Takes

. . . to cut tooling costs 71%, increase production 400% and entirely eliminate your jig costs!

When you inspect the new AMERICAN Positioning Table, you'll find a brand new concept in numerical control!

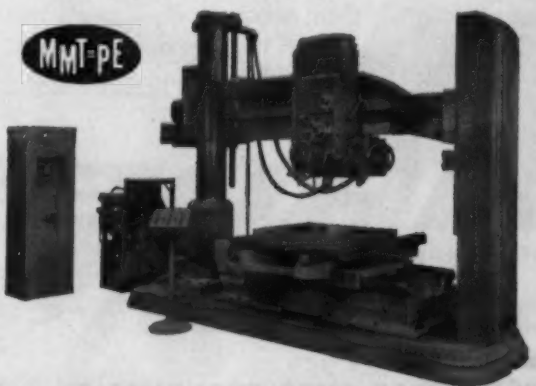
No steel fingers feel and wear the Mylar tape. Entire blocks of information are read at once . . . *by low pressure air* . . . instantly positioning and holding the table without mechanical clamps.

In addition to extremely fast and error proof positioning, the American Positioning Table gives you accuracy of ±.00025" and repeatability of ±.00005" without fail!

Designed by The American Tool Works Company in conjunction with Sperry-Gyroscope electronic engineers, your American ultra-precision Positioning Table is simple to operate and entirely safe from human error.

Ask your American Distributor about "Toolease", our leasing plan under which an American Positioning Table and American Hole Wizard Radial Drill can improve your production . . . while it pays for itself! Or write Section 162 at the address below.

Ask for Bulletins 700 and 801.



THE AMERICAN TOOL WORKS COMPANY

PEARL STREET AT EGGLESTON AVENUE • CINCINNATI 2, OHIO

CIRCLE 186 READER SERVICE CARD

Report to the **SMTS*** *Committee*

*SPECIAL MACHINE TOOL STANDARDS

DELIVERY:

MMT-PE SEE SMTS ECONOMATICS • BOOTH 1440 MACHINE TOOL EXPOSITION

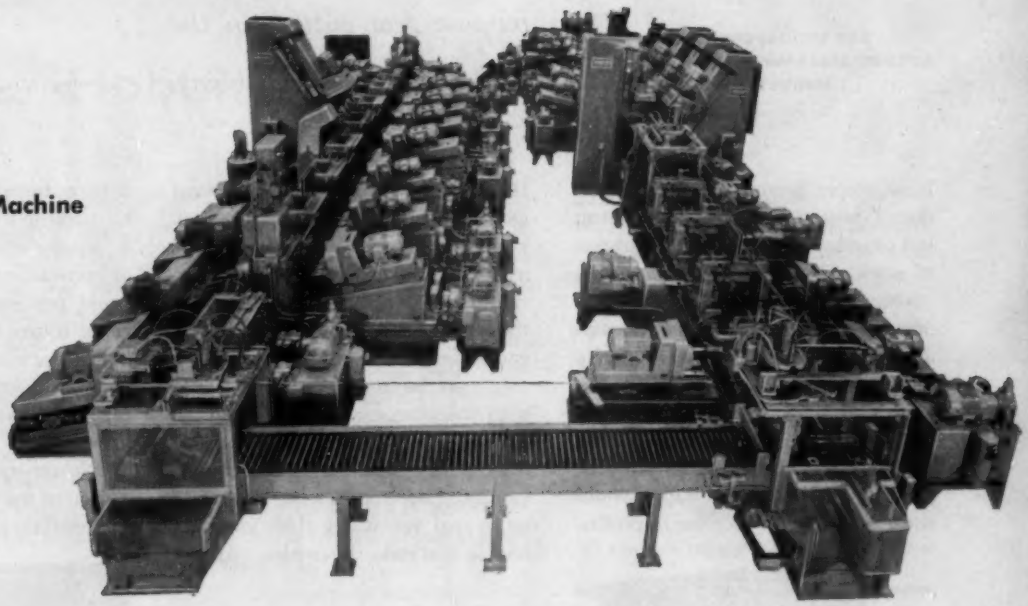
BUHR'S "BABY"

arrives on time . . .

Weight: **225 tons**

Length: **220 feet**

Genus: **Transfer Machine**



What's all the excitement about? Buhr's Baby, the first major machine built to the Special Machine Tool Standards, has been delivered to its proud owner—a major American automobile manufacturer. And it's some baby!

A lift-and-carry, part-through transfer, with fifty-eight stations, the machine is designed to perform 323 precision operations in automatic sequence on cylinder heads for a 1961 model automotive engine. Operations, in addition to rough and finish machining, include probing, sealer application, assembling, pressure testing, rejecting and injecting . . . you name it. It's fast, too. The work cycle is only 30.0 seconds. Capacity at 100% efficiency is 120 pieces per hour. It's some baby, alright! Because it was built to the new Standards, it's the most flexible and readily convertible multiple operation machine tool ever built. It's the first in a broad new line of SMTS Babies that Buhr is now building.

BUHR

(say **BURE**)

ECONOMATIC

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICHIGAN

MODERN MACHINE TOOLS
MMT=PE
PRODUCTION EFFICIENCY

See multicycle hobbing at 1960 Machine Tool Exposition... Booth No. 923.

Here is one of the most promising machine tool developments for general-purpose gear cutting in the history of modern hobbing.

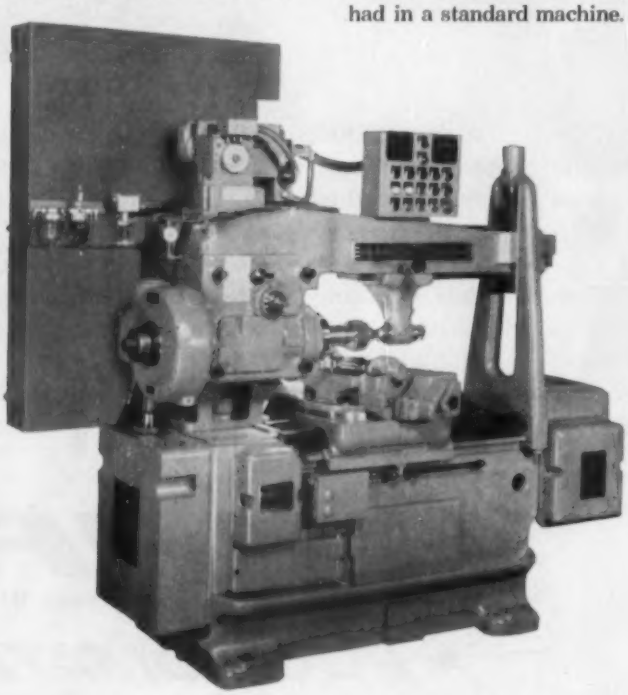
61%

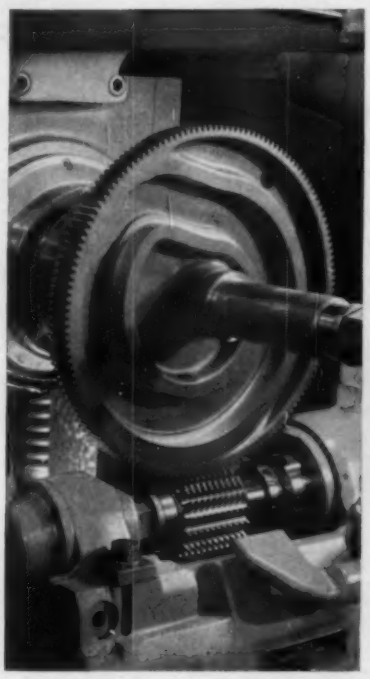
. . . on New

Now, faster production through reduced cutting time and easier setup is a practical reality for a wide range of work. Barber-Colman's new No. 16-16 multicycle machine reduces nonproductive machine time greatly. Job studies noted on the opposite page are typical of what you can expect without a change in material specifications or hob life. Annual savings for the full range of work produced on this machine would show a significant increase in profits.

Hobbing worm gears, splines, helical gears, or spur gears—in 1- or 100-piece lots—you can trim valuable minutes from cycle time without sacrificing finish or hob life. The larger the hob, the more time you save—because nonproductive approach usually can be reduced considerably with the plunge-approach cycle. This is automatic hobbing at its best, with power vertical feed and conventional horizontal feed—also with more real versatility than you ever had in a standard machine. Any of three automatic cycles can be chosen by turning a switch.

1. *Square cycle*—automatic version of conventional hobbing cycle, with rapid positioning of workslide and rapid return of the hob carriage.
2. *Plunge cycle*—automatic vertical feed, with infinitely variable downfeed and rapid positioning of the workslide.
3. *Plunge-approach cycle*—combination of the above to provide shortest possible approach to full depth.





MORE GEARS

Multicycle Hobbing Machine

Once setup is completed, the operator loads, presses the start button, and unloads manually. The big difference is in the way the hob and work are positioned—faster, accurately, automatically, and in the most direct manner.

In reviewing these possibilities for your plant, consider the added advantage of variable downfeed. A worm gear job formerly was done on a conventional machine. With a feed rate of .007" per revolution, followed by a four-revolution dwell, and with a hob speed of 103 rpm, floor-to-floor time was 4.83 minutes.

The same job on the multicycle is done in 3 minutes, floor to floor. Setup time has been reduced from 67 minutes to 55 minutes.

Part of this saving results from constantly variable vertical feed. This provides a high feed rate at the start of the cycle when chip load is light . . . light feed at full depth when chip load is heavy. The *average* feed of .018" per revolution is more than double that used on the change-gear-type machine.

Multicycle machines are now in production in both the Nos. 6-10 and 16-16 sizes. Call your Barber-Colman field representative or write the factory for delivery information.

Barber-Colman Company

BARBER COLMAN ®

51 Loomis Street, Rockford, Illinois

TYPICAL SAVINGS WITH MULTICYCLE HOBBING				
JOB FACTS	Cast Bronze Worm Gear		Cast Iron Spur Gear (shown at left)	
	Conventional (Vertical Feed)	Multicycle (Variable Feed)	Conventional	Multicycle (Plunge Approach)
Hob speed (rpm)	103	120	246	246
Horizontal feed (ipr)	....	....	.060	.060
Vertical feed (ipr)	.007	.018 (average)	....	.030
Approach Distance (in)	....	....	.700	.360
Dwell	4 rev.	24 seconds	....	....
Pieces per hour	12.42	20	6.94	8.68
Setup time (min.)	67	55	85	85
Production increase		61%		25%

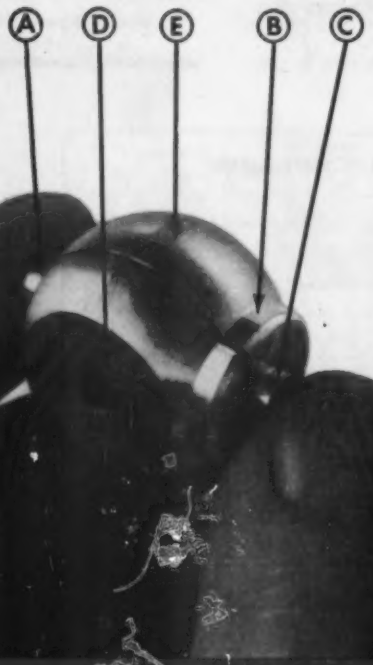
For productiveness in the toolroom

MONARCH YEARS-AHEAD

Versatile as they come

The same basic machine is offered in two standard forms—with screw-cutting equipment as a Toolroom Lathe—without screw-cutting features, as a Manufacturing Lathe. Such additional items as the following improve productivity and enhance versatility.

Air-Gage Tracer
Automatic Cycling
Hydraulic Turret
Steady Rest
Follow Rest
Taper Turning Attachment
Collet Attachments
Air Equipment
Bar Feed Attachment



PRECISION PERFORMANCE

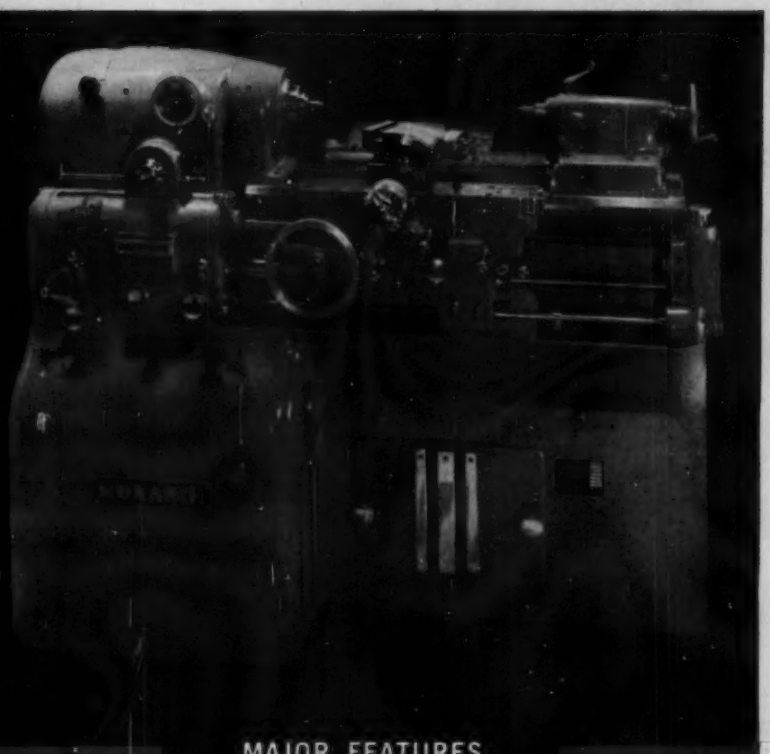
Here's a beautiful example of turning as both a science and an art. Just consider typical tolerances on this miniature gyro gimbal housing:

1. *Diameters A, B, C, E on same center line within .0002" T.I.R. and square to bore D within .0005" T.I.R.*
2. *All outside diameters concentric with inside diameters within .001" T.I.R.*
3. *Wall thickness E .030" ± .001"*
4. *Diameter A +.0002"; —.000"*
5. *Diameter C +.0005"; —.000"*

These units are externally and internally tracer turned to the above tolerances by Vee-Arc Corporation of Westboro, Massachusetts. Air-Gage Tracer equipped Monarch 10" EE Lathes are used—in conjunction with Vee-Arc Super-Precision Live Centers which are accurate within .000020" T.I.R.

for toolroom accuracy in production!

10" MODEL EE PRECISION LATHES



with many refinements PLUS 2 more horses

Any Model EE user will tell you it has long been the lathe of tomorrow. Now it's an even better machine with more power, more convenience, more productiveness.

For precision turning, boring, facing and threading in the toolroom this lathe has no equal. It's fully as proficient for such super-accurate manufacturing operations as required for small jet, missile, instrument, electronic and camera components.

Check the listing of major features; take a look at the job report and the many typical parts turned on this machine. Then, put it up to us to show you how the 10" EE can solve many of your turning problems with EEse.

THE MONARCH MACHINE TOOL COMPANY,
Sidney, Ohio.

If it can be turned
there's a Monarch to do it
better and faster

MAJOR FEATURES

- *5 H.P.* drive direct to spindle through multiple "V" belts, providing an infinitely variable speed range. No gears in the headstock.
- Standard speed range, 5 to 3000 R.P.M.; optional range, 6.5 to 4000 R.P.M.
- D.C. variable speed motor secures its power through an electronic unit which utilizes almost any source of A.C. This type of power supply minimizes vibration at all speeds, practically eliminates noise, improves speed regulation regardless of load and maintains better torque at the lower speeds.
- Spindle comes to dead stop in less than 2 seconds, attains full speed in less than 3 seconds.
- Automatic lubrication throughout.
- American standard Camlock spindle nose—for quick, rigid and accurate chuck and fixture mounting.
- Wide range of threads and feeds through totally enclosed gear box and end gearing.
- Cross feed and leadscrews induction hardened and ground.
- Flame hardened and precision ground bed ways for both carriage and tailstock. Bed all in one piece—no inserts.
- Easy, fatigue-free operation. Base design permits operator to work close comfortably, from standing or sitting positions.
- The only small lathe available with anti-friction bearing taper attachment.
- For thread chasing up to 100% faster, is available with exclusive combination of electric leadscrew reverse and variable reverse speed control.

Monarch
TURNING MACHINES

CIRCLE 192 READER SERVICE CARD

FROM CREATIVE CRUCIBLE: HIGH SPEED STEELS THAT MAKE BETTER TOOLS POSSIBLE

UNGROUND CLASS "C" HOBS, *made from Crucible's M2S, consistently meet runout tolerances as required.*

CIRCLE 193 READER SERVICE CARD

ACCURATE HOBS— WITHOUT GRINDING!

Toolmakers hold hob tolerances to less than 0.001" without finish grinding—because of improved manufacturing skills and continually improved Rex® High Speed Steels.

Today's toolmakers are not only producing accurate unground hobs to closer tolerances – they're also making them stronger, longer-lasting and with fewer grinding stresses.

What is behind this development? It's the skill of the toolmakers – combined with continuing Crucible developments that improve the quality of Rex High Speed Steels. Crucible tool steel metallurgists, working closely with producers of fine precision tools, are able to devise mill manufacturing practices to provide steels ideally suited to specific applications.

At Crucible, Rex High Speed Steels have always been produced under the close personal supervision of the most experienced men in the industry. Today, these men utilize the most advanced electronic instrumentation to assure the production of highest quality steels. For example, they use precision instruments to control the temperature of the molten metal, in the melting furnace, so each heat is produced under identical conditions. New techniques permit greatly improved deoxidation of the liquid steel. New ingot mold designs provide freedom from segregation when the steel solidifies. And all Rex High Speed Steel billets are inspected ultrasonically before they are rolled or forged.

As a result, Rex High Speed Steels continue to make the best hobs because they offer:

more uniform distribution of carbides throughout the section. This ensures minimum size change, greater predictability in heat treatment, greater hardenability and more uniform hardness in the heat-treated tool:

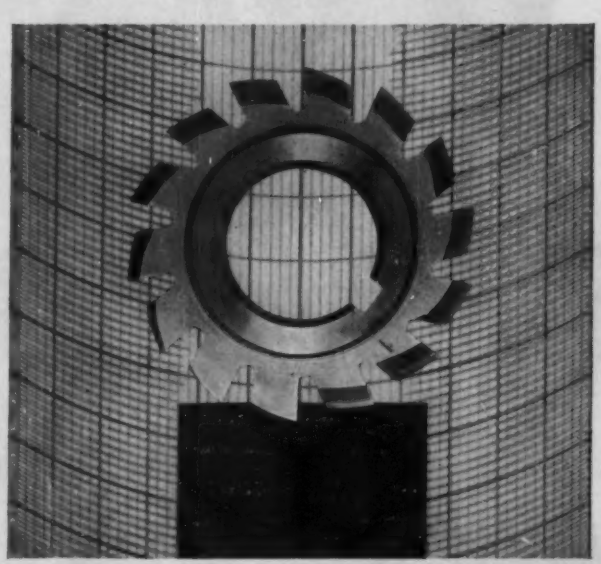
more uniform distribution of sulfides in the free-machining grades. And this provides improved machinability and superior surface finish.

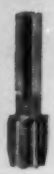
Single-Thread Gear-Hob Tolerances (in Ten Thousandths of an Inch)

	DIAMETRAL PITCH										
	1 Thru 1.999	2 Thru 2.999	3 Thru 3.999	4 Thru 4.999	5 Thru 5.999	6 Thru 8.999	9 Thru 12.999	13 Thru 19.999	20 Thru 29.999	30 Thru 50.999	51 and Finer
RUNOUT											
Outside Dia. C	50	45	40	25	20	17	17	12	12	10	8

Table: Metal Cutting Tool Handbook

FINAL PROOF OF A HOB'S ACCURACY. *This lead variation chart, produced by a special electronic recorder, provides a check of every tooth in the hob. Checks are made "against perfection" — so, any deviation shows up on the chart. Photomicrograph shows tooth area's structure and the uniform distribution of carbides in Crucible Rex M2S. (Photo: 100X dia.)*





BETTER TOOLS, THROUGH BETTER STEELS. *The constant improvement of Rex High Speed Steels ensures the increasingly greater performance of fine twist drills, taps, broaches and cutters — as well as hobs.*

CRUCIBLE STEEL COMPANY OF AMERICA

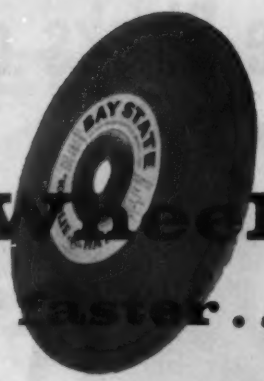
Branch Offices and Warehouses: Atlanta • Baltimore • Boston • Buffalo • Charlotte • Chicago Cincinnati • Cleveland • Columbus • Dallas • Dayton • Denver • Detroit • Erie, Pa. • Grand Rapids • Houston • Indianapolis • Los Angeles Miami • Milwaukee • New Haven • Caldwell, N. J. • New York • Philadelphia • Pittsburgh • Portland, Ore. • Providence • Rockford Salt Lake City • San Francisco • Seattle • Springfield, Mass. • St. Louis • E. Syracuse • Tampa • Toledo • Tulsa • Twin Cities

CIRCLE 194 READER SERVICE CARD

"Man, we never had it so good!"

CIRCLE 195 READER SERVICE CARD

BAY STATE'S NEW "KOOLIE HAT" Wheels are easier, safer and faster . . .

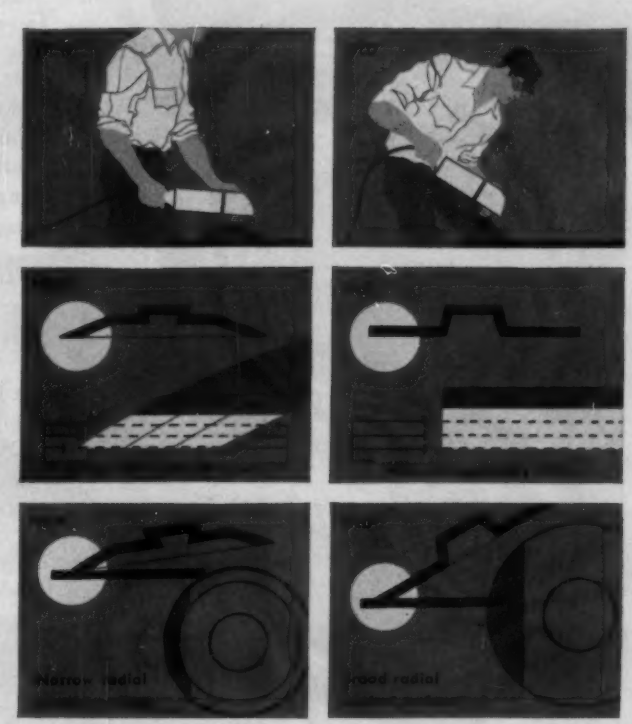


This new wheel shape removes one of the prime causes of accidents in portable grinding and blending, by cutting operator-fatigue. It increases cutting speed, too. Triple-layer, resin-bonded fiberglass construction gives Bay State's new "KOOLIE HAT" wheels extra strength, durability and a controlled contact area so important to portable snagging wheel users.

• Easier Operation
"Koolie Hat" wheel is held at 4° to 5° angle to the horizontal instead of 25° to 30° . . . requires less pressure to hold grinder steady . . . virtually eliminates jitter and bounce, due to extended peripheral contact. Operator grinds in relaxed position with both arms extended about equally... fatigue drops . . . accident rate goes down . . . production climbs.

• Extra Safety
"Koolie Hat" shape ensures uniform wear of all three layers of abrasive at once . . . even when wheel is held flat for smoothing and cleaning. This eliminates danger that results when conventional disc-wheels wear thin over entire surface (see diagram). Prevention of heat build-up also reduces danger of breakage due to heat cracks.

• More Uniform Speed
New "Koolie Hat" shape provides a narrow, radial contact surface between wheel and work. This means that wheel speeds stay high, ensures fast, efficient removal of metal and prevents heat build-up.



These remarkable new wheels are available in two sizes: 7" x ¼" and 9" x ¼". Your Bay State distributor or direct representative is ready now to demonstrate on your work, at your plant. Write today.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

Gage Blocks of CARMET Chromium Carbide

for new standards of dimensional control!

For enduring, ultra micro-accurate surface finishes and dimensional stability, CARMET Chromium Carbide represents the ultimate gage block material.

Harder by nature than steel . . . next to a diamond in hardness, yet far tougher . . . Chromium Carbide Gage Blocks withstand rougher use, eliminate costly dimensional errors, and cut frequency of calibration and replacement. They have a thermal coefficient of expansion similar to steel. Fingerprints are not harmful.

Lightweight, non-oxidizing, possessing superior "wringability" and a stable, fine grain structure that takes and holds a mirror-smooth gaging surface . . . CARMET Chromium Carbide in gage blocks is leading the way to rigid new standards of dimensional control.

Carmet doesn't make gage blocks, but furnishes the chrome carbide to the progressive manufacturers who do.

A precise blend of extremely hard, finely divided carbides of chromium with a nickel binder, CARMET Chromium Carbide assures predictable, consistent behavior and unmatched uniformity from piece to piece.

These same unique characteristics make CARMET Chromium Carbide an important material for extrusion dies, valve seats, sealing rings, chemical processing equipment . . . or any other application where resistance to oxidation, corrosion, abrasion, erosion or chemical attack may be involved. For more information, contact your local Allegheny Ludlum CARMET representative, or write: ***Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan.***

1728

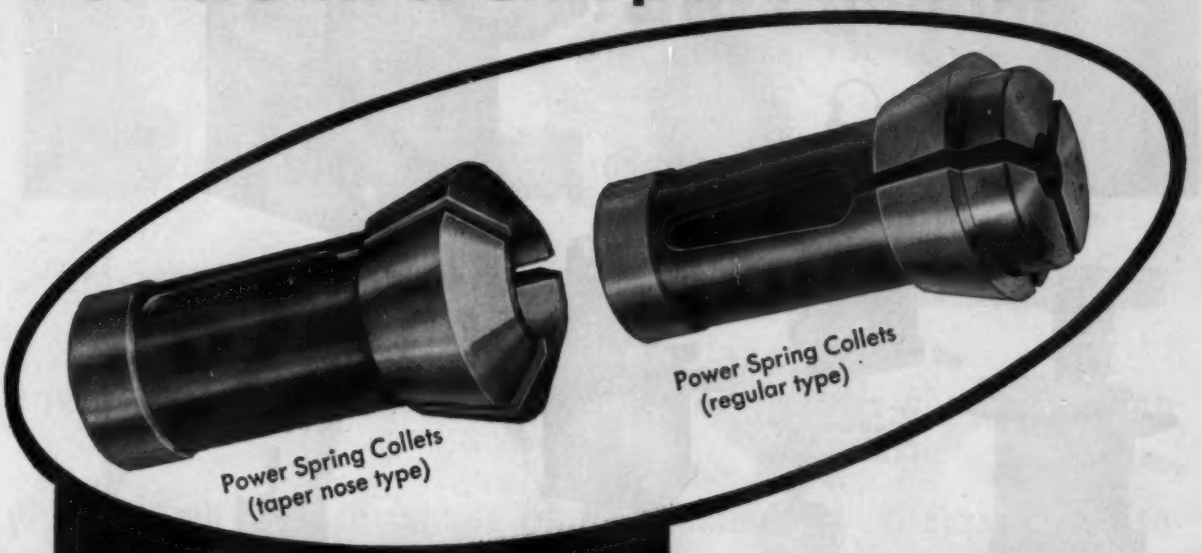
CARMET®

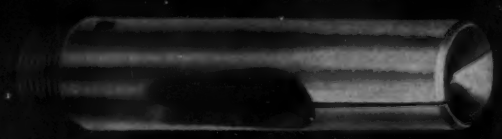
CEMENTED CARBIDE · DIVISION OF ALLEGHENY LUDLUM

HARDINGE
ELMIRA, N.Y.

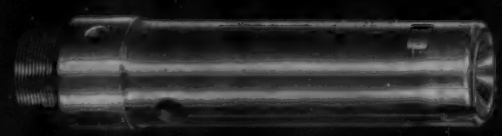
COLLETS and FEED FINGERS

For Brown & Sharpe Machines

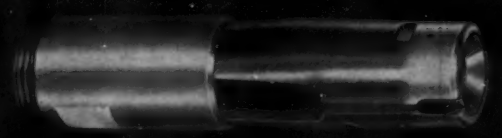




Feed Fingers (regular type)



Master Feed Fingers and Pads



Master Feed Fingers with Adjustable Tension for No. 00, 00G, 0 and 0G Machines.

To get maximum production efficiency from your Brown & Sharpe Machines — specify HARDINGE Collets and Feed Fingers.

Specifically engineered, customer-shop tested and approved for Brown & Sharpe Machines, Hardinge Collets and Feed Fingers will reduce tooling costs and step up production.

Immediate Stock Delivery From:
Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia, Oakland, Minneapolis, St. Louis, Springfield, N. J., Rochester, N. Y., Portland, Seattle, Toronto.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

EXTRA RUGGED... SPEEDY... ACCURATE...

to Bring Down Milling Costs!

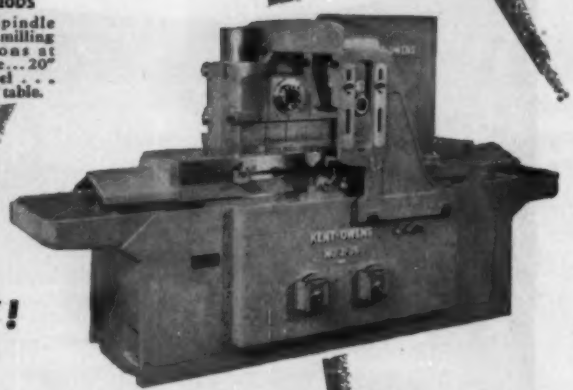
No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 1-14. 32" x 9" table . . . 14" table travel . . . hydraulic table feed . . . full automatic cycle.

No. 2-20DS Double Spindle for two milling operations at same time . . . 20" table travel . . . 42" x 12" table.

No. 1-14DS Double Spindle for two milling operations at same time . . . 14" table travel . . . 32" x 9" table.

No. 2-20V 20" table travel . . . vertical spindle with speed range 32 to 1284 R.P.M. . . . 42" x 12" table.



No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

STEP UP SPEED and ACCURACY!

Put the work on Kent-Owens Machines for top-speed milling and topmost accuracy to keep your costs at a minimum! Advanced features throughout make the difference . . . greater dependability . . . accuracy maintained. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to spindle. Write for bulletin #757 on wide range of hydraulic and hand-operated machines. Let us quote on proper machine complete with tooling for your operation. Also, call on Kent-Owens for special machines. Kent-Owens Machine Co., Toledo, Ohio.

KENT-OWENS
for milling machines

See us at The Machine Tool Exposition Booth 547

KENT-OWENS REPRESENTATIVES

BOSTON — General Machinery Corp.
BUFFALO — Beasley-Mathiesen Mach'y Co.
CHICAGO — Penn Souare Mach'y Company
CLEVELAND — Gosco Machinery, Inc.
DALLAS — Hamer Machine Tool Co.
DAYTON — C. H. Geringer Mach'y Co.
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FT. WAYNE — Ossit Machinery Co.
GRAND RAPIDS — Joseph Hinselman & Co.
HAMILTON, ONT. — R. P. Barber Mach'y Company
HARTFORD — Harrington-Wilson-Dunn Corporation
HOUSTON — Oliver H. Van Horn Co., Inc.
INDIANAPOLIS — Ossit Machinery Co.
KANSAS CITY — Blakeman Machinery Co.
LOS ANGELES — Machinery Sales Co.
MILWAUKEE — Penn Souare Mach'y Company
MINNEAPOLIS — The Industrial Company
MOLINE — John T. Hernando Co.
MONTREAL — R. P. Barber Mach'y Co.
NEW ORLEANS — Oliver H. Van Horn Co., Inc.
NEW YORK — Harrington-Wilson-Dunn Corporation
OMAHA — The Babcock Co.
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ROCHESTER — Schleicher-Pfaltzgraf Machinery Corp.
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ST. LOUIS — Wm. Schaer Company
SEATTLE — Earlbeck Machine Tool Co.
SYRACUSE — R. P. Owens Mach'y Company
TORONTO, ONT. — R. P. Barber Mach'y Company
WINDSOR, ONT. — R. P. Barber Mach'y Company

Here are thread and form grinders that give you toolroom precision plus production line speed.

Plunge grind threads 1¾" long in a turn and a half or traverse grind long threads as fine as 60 pitch

And you have a choice of Crushtrue® wheel dressing (or multi-rib or single-rib diamond wheel-dressers) with manual or automatic crushing. Furthermore, Crushtrue dressing is ideal for grinding intricate profiles.

Sheffield's versatile standard Thread and Form Grinders (Model 101, illustrated, capacity 7″ diameter x 12″ long; Model 103, 7″ diameter x 24″ long) are equally at home in the tool room making one of a kind precision threads, or in the production line plunge grinding thousands of threaded or profiled parts.

Wheels may be diamond dressed . . . or Crushtrue® dressed for these advantages:

Greater production: wheel is sharper, grinds cooler. Faster stock removal: no dull flats, no burning, no loading up. Faster redressing: wheel is redressed in seconds. Highly accurate: tolerances on width within .0002″, radii within .002″, straight sides within .003″. RMS finishes as low as 8 microinch, grooves as narrow as .020″.

Standard accessories and special loading, holding, and ejection devices can be made available for specific high production jobs.

May we send you TFG 1159 catalog on models 101 and 103 and Bulletin CR 355 on the remarkable advantages of Crushtrue® grinding?

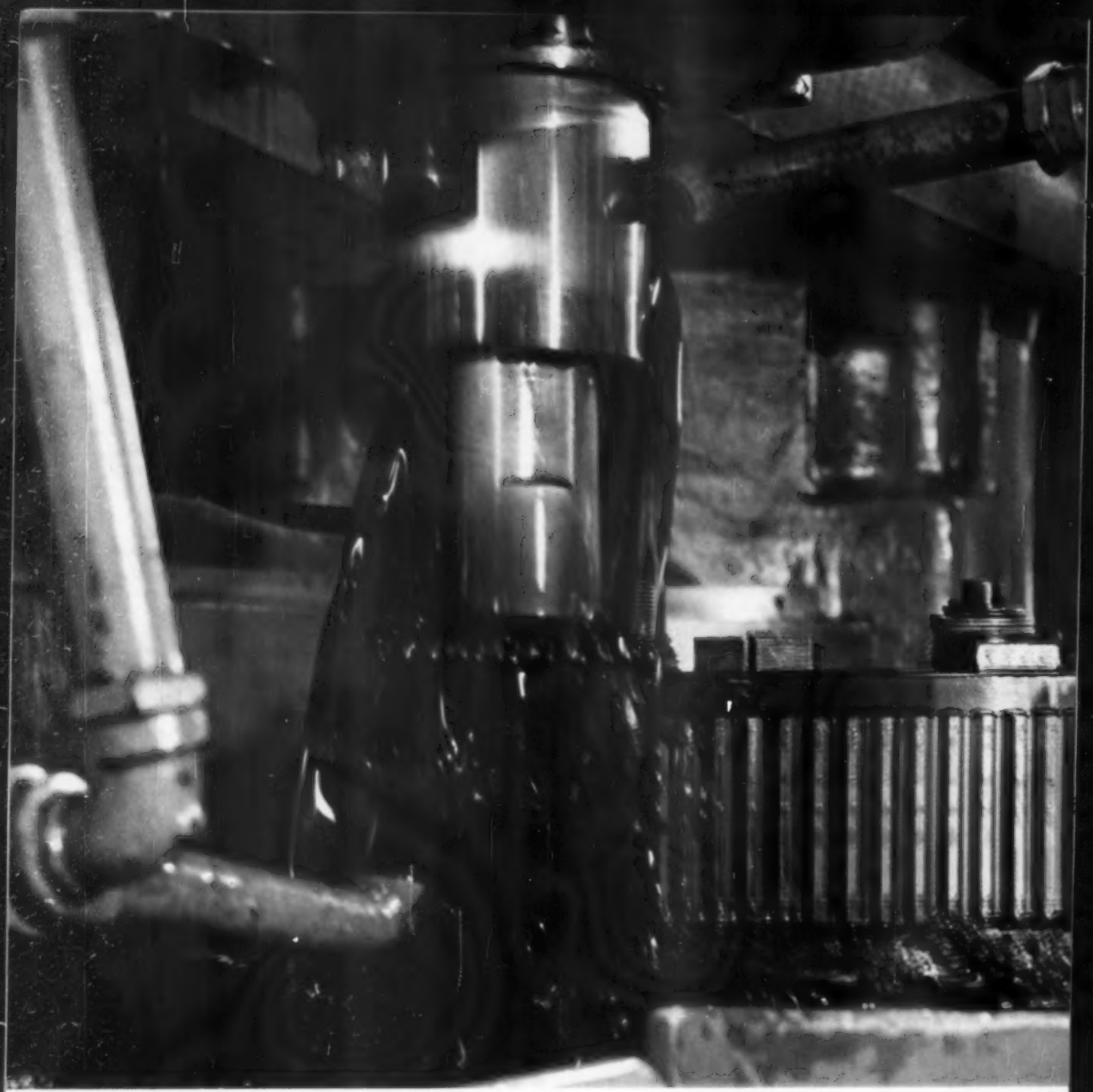
The **SHEFFIELD** *Corporation* *Dayton 1, Ohio*

A subsidiary of the Bendix Corporation

Gages, Measuring Instruments, Automatic Gaging & Assembly Systems • Machine Tools • Contract Mfg.

▲ CIRCLE 200 READER SERVICE CARD

CIRCLE 201 READER SERVICE CARD ►



Switch to Gulfcut® oil doubles tool life for

GULF MAKES THINGS

Gang-cutting 120 teeth in stacks of 50 clutch discs made of SAE 1035 steel, .090-in. thick, to tolerances of .0033" at relatively high feeds and speeds is rough on cutting tools. But Gulfcut 21C oil makes it just half as rough at American Brakeblok Division of American Brake Shoe Company, Cleveland, Ohio.

Says Edward Salamon, Product Engineer, "As the cutting tool on the Fellows Gear Shaper enters each disc, there is an impact, generating additional heat and increasing the tendency for the tool to chip. With the machine making 86 strokes a minute tool life used to be rather short. Since changing our cutting oil to Gulfcut 21C we've achieved two benefits: we've doubled our tool life, and we've rid the operation of the very unpleasant odor of the previous oil."

"The substantial increase in tool life and over-all oper-

Wally Pavlak, Foreman, left, shows Thomas F. Irving, Gulf Sales Engineer, that tolerances of .0033" have been maintained with help of Gulfcut 21C.

Changing to Gulfcut 21C has doubled tool life in this Fellows Gear Shaper, here cutting a stack of 50 clutch discs, each .090-in. thick.

American Brakeblok . . .

RUN BETTER!

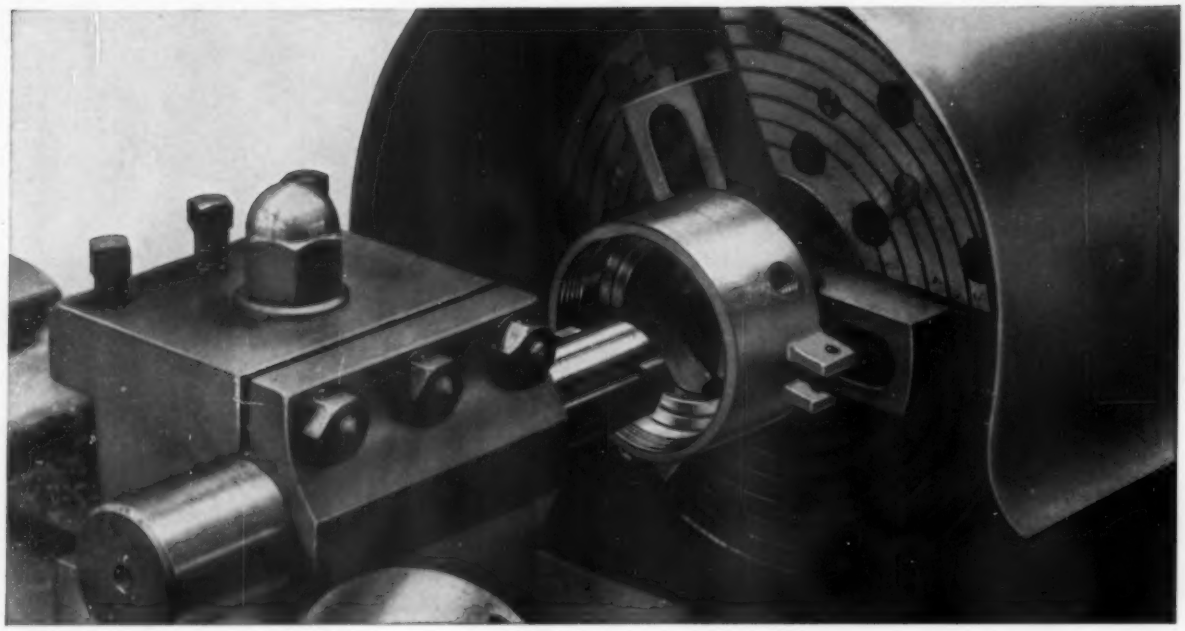
ating efficiency," says Mr. Salamon, "has shown us that we don't need to be cutting oil specialists. We just call in a Gulf Engineer to provide the answers."

See for yourself how Gulf makes things run better! A call to your nearest Gulf office will bring a Gulf Sales Engineer with practical help. Meanwhile, send for your free copy of "Metal Machining with Cutting Fluids," the new 116-page handbook on their selection and use.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF

SP 9821



Threaded in just 6 seconds on a Gisholt CRI-DAN

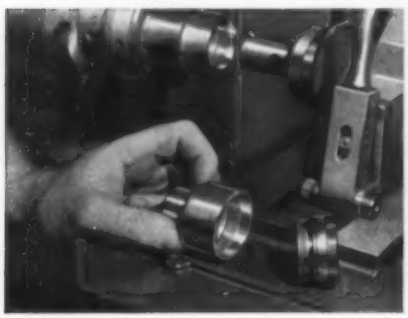
Here's a good example of what you can do on a Gisholt CRI-DAN Threading Lathe—an internal thread, 2 3/16" diameter x 1/4" long, 12 t.p.i., cut in a phosphor-bronze bearing housing in just six seconds.

Speed and versatility obsolete other methods.

Note the other jobs shown—the variety of work and the fast threading times. Simple on a CRI-DAN—yet, each presented problems that could only be solved at high cost using any other method.

It's Cri-Dan for highest quality, lowest cost.

The jobs shown here prove that close tolerance and high-quality finish requirements are met easily on the CRI-DAN. The CRI-DAN method, using an inexpensive single-point carbide tool, is faster and less costly than thread grinding or thread milling.



20 seconds—Zoom operating sleeve for movie camera; aluminum; I.D. pilot dia. bored; tool indexed for threading a 2-start, .0625-pitch, .125"-lead, Class 4 16NS thread in the 1.610" center section.

15 seconds—spinning roller; stainless steel; 18 t.p.i. thread on 1/2" diameter for 7/8" length.

GET THE FACTS—NOW! Two models are available—both are capable of handling high-production work or a wide variety of short-run jobs. Change-over averages ten minutes. Write for our catalog—or ask your Gisholt Representative for complete details.

GISHOLT® MACHINE COMPANY
Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

MMT=PE

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

◀ CIRCLE 202 READER SERVICE CARD

CIRCLE 203 READER SERVICE CARD ▲

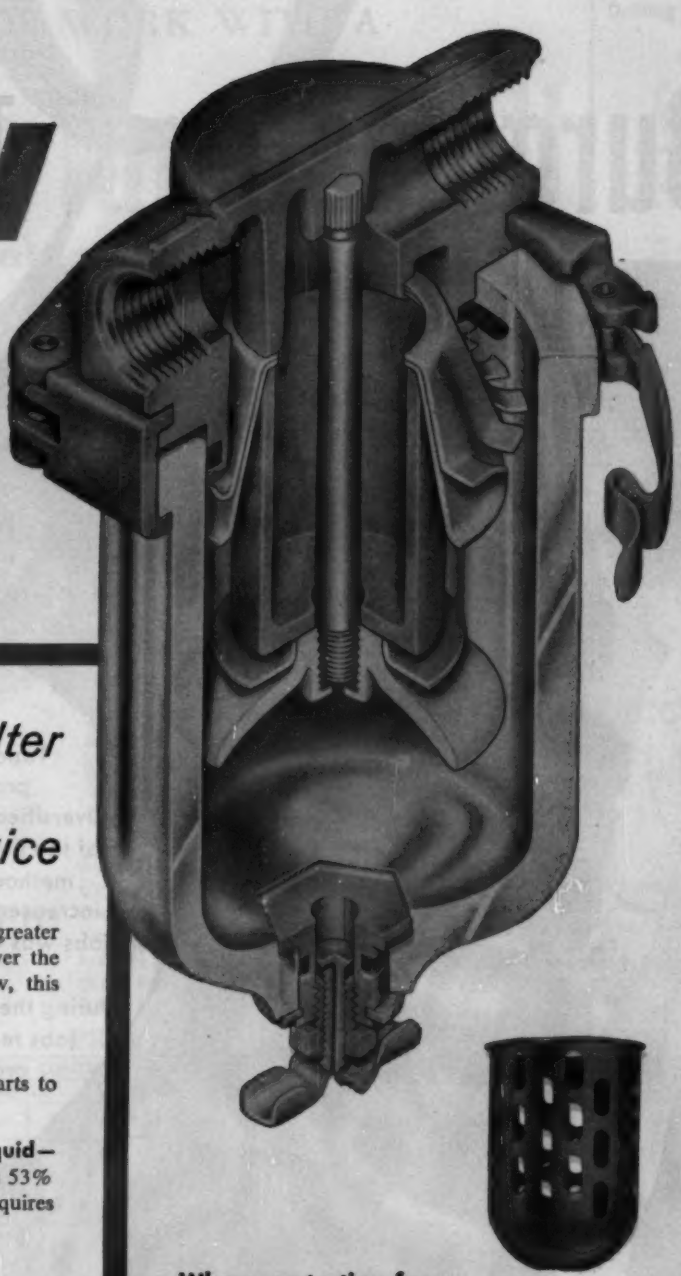
Announcing

NEW

Norgren

COMPRESSED AIR LINE FILTERS

for ¼", ⅜" and ½" pipe sizes



The most efficient filter you can buy...
the easiest to service

1. **100% liquid removal—**
Improved Norgren design provides a greater than ever liquid removal efficiency. Over the entire range of recommended air flow, this filter effectively traps all liquids.

2. **Easier and quicker to service—**
No tools needed and only 4 separate parts to handle.

3. **Larger bowl capacity for collected liquid—**
The "quiet zone" below the baffle holds 53% more collected air-line contaminants. Requires less frequent draining.

4. **New improved bowl—**
New, stronger transparent bowl has greatly improved resistance to fatigue failure.

PLUS *these important benefits:*

- **Highly effective removal of solids.**
- **Optional interchangeable filter elements—** 74, 64, 25 or 5 micron.
- **Reduced service time**—the simplest, easiest filter to disassemble and clean.

Where protection for transparent bowls is required,
a metal bowl guard, held in place by the clamp ring, is available.

For complete information about Norgren's complete line of manual drain and automatic-drain compressed air line filters, call your nearby Norgren Representative, listed in your telephone directory—or WRITE FOR BROCHURE NA-1.

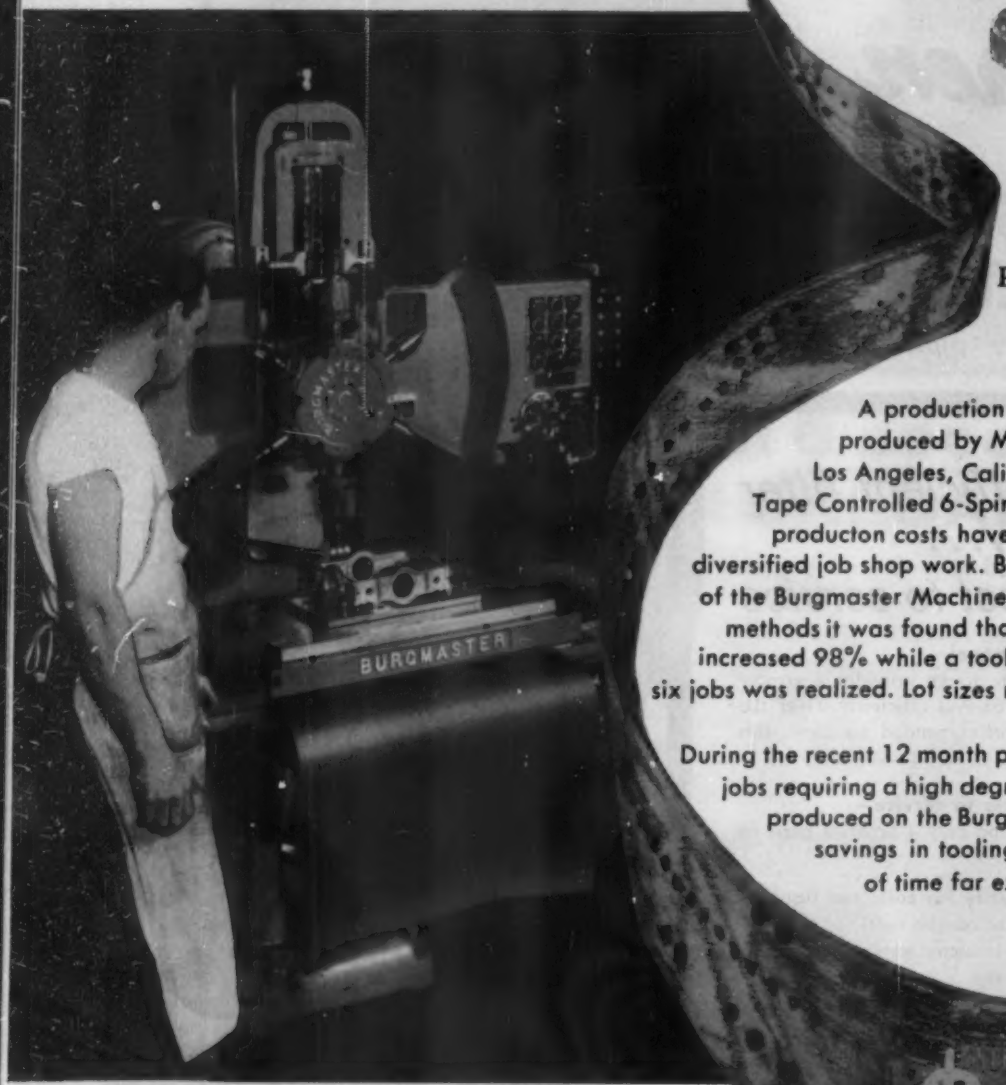
FOUNDED IN 1926

C. A. NORGREN CO.

3436 SOUTH ELATI STREET • ENGLEWOOD, COLORADO

PRODUCTION INCREASED UP TO 98%

Burgmaster Tape Controlled



$3260 SAVINGS

$165 COST

TOOL SAVINGS ALONE PAY FOR MACHINE IN LESS THAN 1 YEAR

A production analysis of six typical jobs produced by Mechanical Specialties Co., Los Angeles, California on their Burgmaster Tape Controlled 6-Spindle Turret Drill shows that producton costs have been sharply reduced on diversified job shop work. By comparing the operation of the Burgmaster Machine with conventional drilling methods it was found that average production was increased 98% while a tool savings of $3260 for the six jobs was realized. Lot sizes ranged from 1 to 50 parts.

During the recent 12 month period, over 100 diversified jobs requiring a high degree of precision have been produced on the Burgmaster at this plant. The savings in tooling costs alone in this length of time far exceed the cost of the Tape Controlled Burgmaster.

THE IDEAL MACHINE FOR THE JOB SHOP — MAXIMUM FLEXIBLE AUTOMATION

Mechanical Specialties says, "Lots of any size are produced more economically on our Tape Controlled Burgmaster Machine — small lots are no problem." This is because tooling costs — and lead time — are greatly reduced. Jigs and complex fixtures are not required. Instead, simple work holding devices and standard clamps are ordinarily used.

Parts are produced faster and to greater precision because all machine functions are controlled by tape, eliminating the human factor. The positioning table locates the work under the turret within ±.001" for each operation. During each turret index, the spindle in the working position automatically shifts to the preselected standard machine settings of speed, feed and depth of cut.

THE MACHINE TOOL

MMT-PE

Booth 840

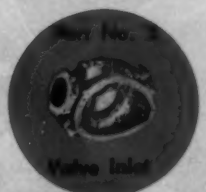
Exposition - 1960

$3260 TOOL SAVINGS
IN DIVERSIFIED JOB SHOP WORK WITH A

Six-Spindle Turret Drill

(at mechanical specialties co., los angeles)

14 holes include c-drill, drill, c'bore, chamfer and tap. Savings: tooling 7 hrs./75 hrs., machine time: .4 hrs./ 1.8 hrs.

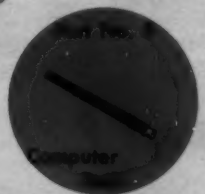


28 holes in 2 setups include c'drill, drill, c'bore, chamfer and tap. Savings: tooling 3 hrs./115 hrs. machine time 1.2 hrs./3.6 hrs.

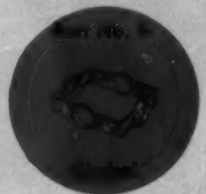
10 holes in two setups include c'drill, spotface, drill and tap. Savings: tooling 5 hrs./ 90 hrs.

9 holes include c'drill, spotface, drill, tap and bore. Savings: tooling 4 hrs./30 hrs., machine time .7 hrs./ 1.1 hrs.

SIX TYPICAL JOBS SHOW SAVINGS ON TAPE CONTROLLED BURGMASTER COMPARED TO CONVENTIONAL DRILLING METHODS.



50 holes include c'drill, drill, c'bore-chamfer, and bore. Savings: tooling 8 hrs./215 hrs., machine time 1.7 hrs./ 2.8 hrs.



140 holes in 6 setups include c'drill, drill and tap. Savings: tooling 6 hrs./ 120 hrs., machine time 2.3 hrs./4.5 hrs.

PRODUCTION DATA CHART

Part No.	Part Name	BURGMASTER TAPE CONTROL: Program and Punch Tape Hrs.	TOOLS Hrs.	TOOLS $	Mach. Time Hrs.	CONVENTIONAL DRILLING: TOOLS Hrs.	TOOLS $	Mach. Time Hrs.	No. of Setups	No. of Holes	Operation
1	Valve Body	.5	7	35.00	.4	75	375.00	1.8	1	14	Ctr Dr Dr Ch C'br Tap
2	Hyd Cont. Valve Inlet	3.1	3	15.00	1.2	115	575.00	3.6	2	28	Ctr Dr Dr Ch C'br Tap
3	Missile Component Ring	.8	5	25.00	1.4	90	450.00	1.4	2	10	Ctr Dr SF Dr Tap
4	Ring for Missile	.6	4	20.00	.7	30	150.00	1.1	1	9	Ctr Dr SF Dr Tap Bore
5	Computer Rail	.7	8	40.00	1.7	215	1075.00	2.8	1	50	Ctr Dr Dr CB-CH Bore
6	Gimbal	4.1	6	30.00	2.3	120	600.00	4.5	6	140	Ctr Dr Dr Tap

Write for Bulletin describing Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling, Tapping and Boring Machines. Forty-minute 16mm sound film showing all Burgmaster Turret Drills in operation is available without charge.

World's Largest Builder of Turret Drilling Machines

"0" Manual Power Index ¼" Capacity

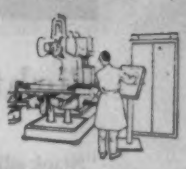
1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity

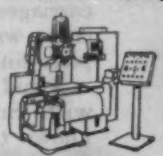
2BR Ram Type Radial Drill ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity



25AH Automatic Tape Controlled 1¼" Capacity



2BHT-3BHT Automatic Tape Controlled - ¾" and 1½" Capacity

BURG TOOL

MANUFACTURING COMPANY, INC.

15001 South Figueroa St., Gardena, Calif.
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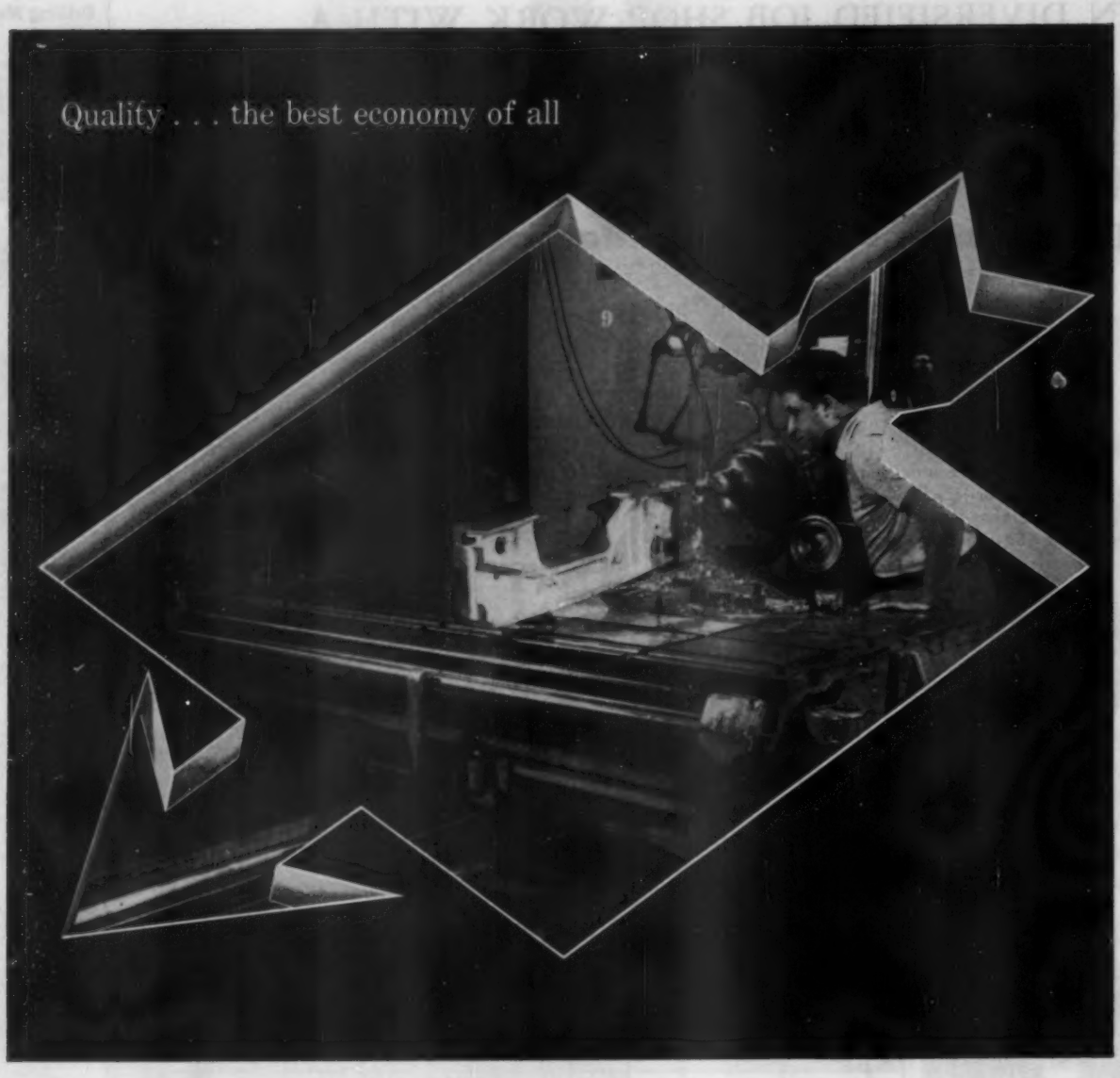
Plus dealer representatives in other industrial centers.

CIRCLE 206 READER SERVICE CARD



Fight the cost of "Stick-Slip" with Sunoco Way lubricant

"Stick-slip", the alternate grabbing and releasing of slow-moving carriages, can seriously score machine ways and ruin fine workpiece finishes.

Avoid this trouble and expense with Sunoco Way Lubricant, known throughout the world for its ability to cure "stick-slip". Special ingredients in Sunoco Way Lubricant form a durable, reinforced lubricating film along the mating surfaces. Result: There is no metal-to-metal contact even during week-end shutdowns; machines start easily; carriages move without intermittent grabbing. YOU GET FINER FINISHES, FEWER REJECTS.

Ask your Sun representative to show you how others have benefited by using Sunoco Way Lubricant. Or write to Dept. AM-7. SUN OIL COMPANY, *Philadelphia 3, Pa.* In Canada: Sun Oil Company Limited, Toronto and Montreal.

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

now... over

330

standard Microbore boring bars from stock!

Your choice of over 330 Microbore standard single-tool or two-tool precision boring bars. A complete range of sizes and types available for boring and facing operations on any make of boring machine, milling machine or turret lathe. *Microbore micrometer vernier adjustment of each tool point* makes it possible to quickly set tools to *precise dimensions.* Boring range from ½" to 7¼" dia. Standard Boring Rings and Adapters extend range to 13¾". Available with Straight Shank, NMTB Taper, Morse Taper or Flash-Change. Carbide, ceramic, or high speed steel cartridges. Ordering is Simple! Fast! Direct! Standardize on Microbore—the complete tooling system.

Catalog No. 58 lists industry's most complete line of standard general purpose precision boring bars. Write for your copy.

Also available—special tooling designed from your part prints by our Proposal Engineering Department.

DeVlieg Microbore® System

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street, Royal Oak, Michigan

CIRCLE 208 READER SERVICE CARD

The Sundstrand System of

New 5-Axis Omnimil turns hours into minutes

. . . a one-machine "production line" — handles every operation required on many parts with a single setup.

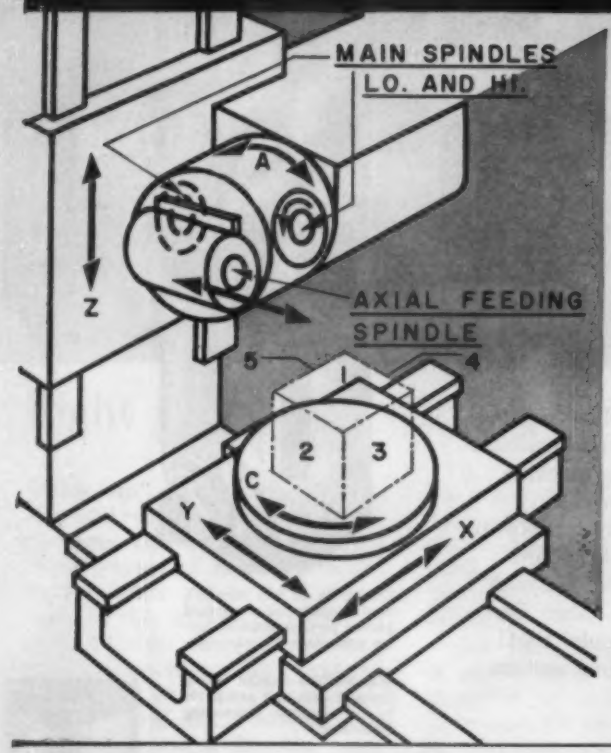
. . . mills, drills, bores, reams, taps all exposed faces of the workpiece at any angle.

. . . positions to ±.001" accuracies.

. . . performs both point-to-point and contour machining.

Model OM-4 illustrated handles parts up to 4' x 4' x 4'.

Model OM-3 for parts to 2' x 2' x 2' available with automatic tool changer to multiply your savings.



Almost unbelievable versatility and cost-reduction potential are provided by the new Sundstrand numerically controlled 5-axis Omnimil.

All machine functions, including optional automatic tool change (not illustrated) are under numerical control. As illustrated at the left, 360° positioning of the workpiece is provided by the rotary table. X- and Y-axis positioning are provided by the table and saddle. The head travels in the Z-axis on the column and rotates a full 360°.

The main head carries two spindles, one for high and one for low-range speeds. These spindles are used with feed applied to table, saddle, head, or any combination of the three. Auxiliary head attached to the main head feeds parallel to the centerline of main spindle.

Machining can be performed at virtually any compound angle on the workpiece, and holes can be drilled, tapped, or bored square in respect to any angular face. Contour machining can be performed by combining any of the 5-axis motions as required.

The Omnimil is one of a complete system of standard and special numerically controlled machines developed by Sundstrand because no one type of machine can be best for every requirement. The machines illustrated at the right typify the range of the line.

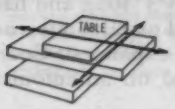
Ask for a Sundstrand "Engineered Production" analysis of your operations — and be sure to visit Sundstrand at the Machine Tool Exposition, Booth No. 1014.

SUNDSTRAND

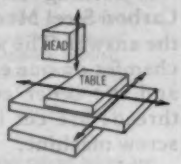
SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

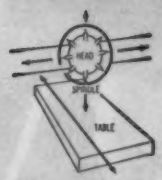
Numerically Controlled Machines



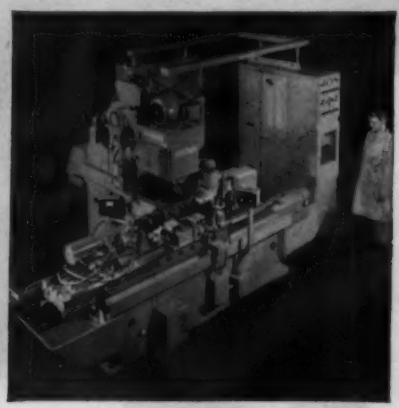
2-axis, 20″ x 30″ Sundstrand Jigmatic positioning table placed under existing machines, such as radial drills, eliminates jigs, positions accurately to ±.001″

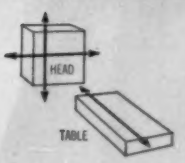


A moderately priced machine with 2-axis positioning of work consists of one or more vertical heads on a simple frame above a Sundstrand numerically controlled Jigmatic table.

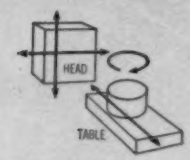


New machine with rail-mounted turret head and 40″ x 60″ table handles workpieces too large for the Jigmatic table. All motions, including turret rotation, are numerically controlled.

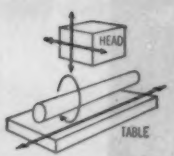




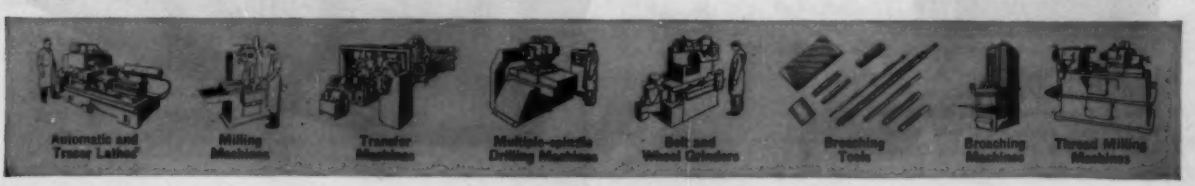
3-axis machine with railhead and 20-position numerically controlled tool changer brings new efficiencies to drilling, boring, reaming, tapping, and light milling. Table size is 40″ x 60″.



3-axis machine for boring, drilling, reaming, tapping, and milling. Available with numerically controlled index fixture which presents all four sides of the workpiece to the cutting tools.



Sundstrand "Engineered Production" machine designed to mill locating spots on six different crankshafts. The basic components are standard. The spindle and workpiece are numerically positioned.



another tough problem solved with...

REPUBLIC ELECTRUNITE MECHANICAL TUBING

Republic's tube making know-how and fabricating facilities combined to solve a tough problem for the Kuhlman Electric Company, Birmingham, Michigan.

Kuhlman engineers wanted a material to meet the designs of the new Kuhlman "Quick-Grip" H.V. transformer bushing that would reduce radio noise without oil. They preferred the part supplied as a finished product.

A bushing sleeve made of Republic ELECTRUNITE Carbon Steel Mechanical Tubing, 2⅛" O.D., 10-gage, was the answer. The sleeve is approximately 3" long and has a chamfer on one end. Holes are punched on circumference, and the other end of the tubing is expanded. Coarse threads are cut in the expanded metal on an automatic screw machine.

This is a typical example of the flexibilities in fabrication of ELECTRUNITE. And Republic's Steel and Tubes Division has the facilities, equipment, and "know-how" to fabricate all grades and types of ELECTRUNITE carbon and stainless steel tubing into whatever shapes your product requires.

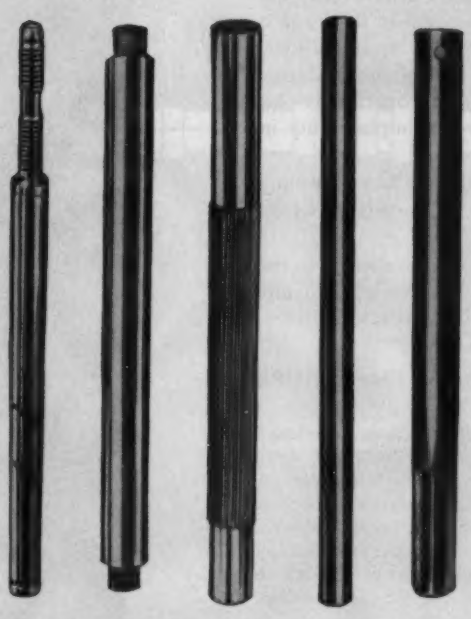
ELECTRUNITE is available in a wide range of sizes, gages, and wall thicknesses in both carbon and stainless steel. Call your Republic representative. Or, write direct. Use coupon below.

The Kuhlman "Quick Grip" H.V. sleeve, made of Republic ELECTRUNITE Mechanical Tubing, is a feature of the K-E Kuhlman Transformer, engineered and manufactured by the Kuhlman Electric Company, Birmingham, Michigan.

CIRCLE 211 READER SERVICE CARD

REPUBLIC NYLOK NUTS proved to be the solution for fast production and plus-safety features in the manufacture of an automobile steering mechanism, shown above. NYLOK nuts are ideal for automatic feeding, and give permanent, vibration-proof lock. Easy adjustment and re-use assured by permanent resiliency of the nylon pellet. Can be easily backed-off for parts inspection and adjustment. Write for data.

REPUBLIC DIE-FORM BLANKS REDUCE COST of Ford Tractor power take-off countershafts. Because the Die-Form blank (right) closely approximates the completed part (far right), scrap losses are negligible and machining is held to a minimum. Die-Form is a new method of cold forming hot rolled carbon, alloy, or stainless steel bars into multi-diameter blanks ready for final machining. Handling costs and scrap disposal are reduced. Production rates are increased. Write.



REPUBLIC CENTURY SERIES of high strength, stress-relieved, cold finished steel bars meet the needs of steel parts producers requiring high strength with varying degrees of machinability. Available in five grades—C-1144, C-1141, C-1151, C-1050, C-1045—with each grade having a minimum yield strength of 100,000 psi. The CENTURY SERIES assures dimensional stability with excellent machinability, provides high mechanical properties in a range of chemistries. Send for booklet.

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World's Widest Range of Standard Steels and Steel Products

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1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

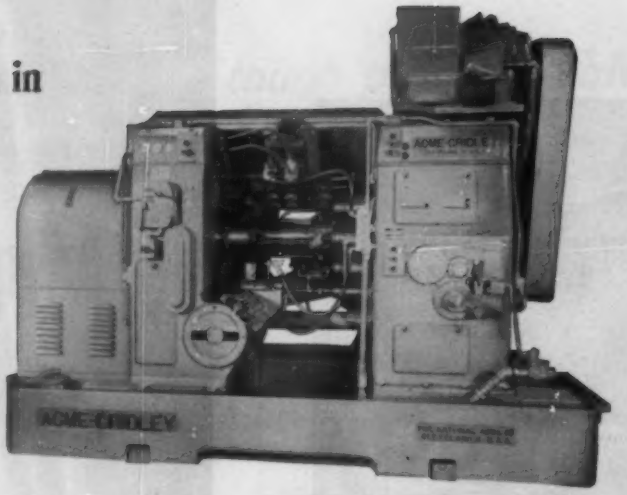
Please send more information on the following products:

☐ Republic ELECTRUNITE® Mechanical Tubing
☐ NYLOK® Bolt and Nut Fasteners ☐ Republic Die-Form
☐ Republic CENTURY SERIES Cold Finished Steel Bars

Name_____ Title_____
Firm_____
Address_____
City_____ Zone____ State_____

CIRCLE 212 READER SERVICE CARD

Major breakthrough in shaft production . . .



Acme-Gridley multiple-spindle shaft machine equals output of four automated lathes

At Chrysler Corporation's Trenton, Michigan, Engine Plant, a remarkable new National Acme shaft turning machine has slashed camshaft production costs; is hailed as a major production development for the entire industry. Performing complete shaft journal machining in a single set-up, this rugged 6-spindle automatic provides substantial savings in floor space and capital outlay, reduces scrap loss and enables closer control of machining operations.

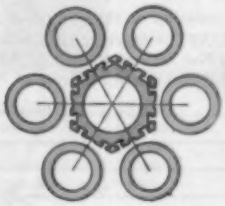
Key to this dramatic pay-off are imaginative National Acme solutions to the difficult problems of centering, driving, and stabilizing the long, flexible shaft during turning operations. An ingenious part-holding technique exposes bearing journals for turning—an impossibility in a chucking set-up.

Extreme capability is stressed in the design of the Universal Multiple-Spindle Shaft Turning Machine and permits the maximum number of machining operations to be performed on straight or flanged shafts held between centers.

The shaft turning machine is additional evidence of National Acme know-how applied to the solution of special machining problems. This same insight and ability is available to any manufacturer interested in reduced costs and increased production. Our representative is as close as your telephone.

National Acme's "Zone of Responsibility" includes all phases of cost reduction. Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Chrysler Corporation . . . an "everyday" job for Acme-Gridleys. **Indirect Costs:** effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc. **Product Redesign:** teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities. **Direct Material Costs:** our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems. **Make-or-Buy Reviews:** in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment. **Spot Modernization:** pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.



National Acme

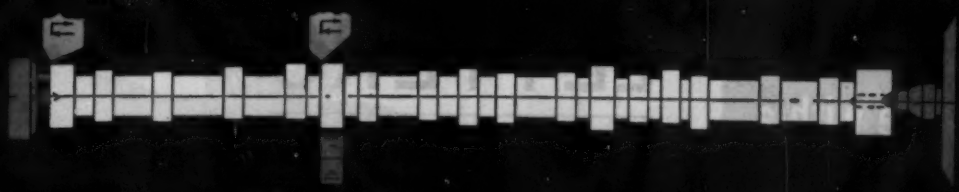
MMT-PE

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

CIRCLE 213 READER SERVICE CARD

1st position—load and unload

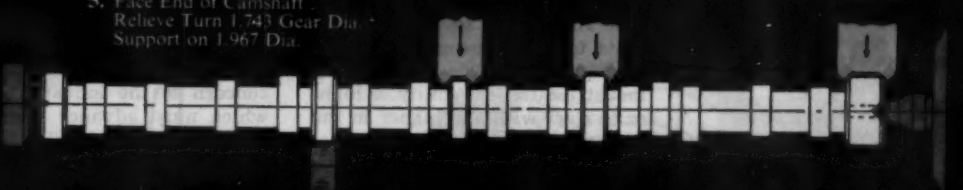


2. Form Turn 1.951 Dia.
Form Turn 1.967 Dia.

3. Form Turn 1.982 Dia.
Form Turn 1.998 Dia.
Support on 1.967 Dia.

4. Chamfer O.D. of 1.951 Dia.
Chamfer O.D. of 1.967 Dia.
Face Sides of 1.743 Dia.
Support on 1.967 Dia.

5. Face End of Camshaft
Relieve Turn 1.743 Gear Dia.
Support on 1.967 Dia.



6. Chamfer O.D. of 1.743 Dia.
Chamfer O.D. of 1.982 Dia.
Chamfer O.D. of 1.998 Dia.
Support on 1.967 Dia.

High-test cast iron camshaft with journal machining completed . . . 13 operations in 22 seconds.

Close-up of tooling zone. Open spindlesin load and unload position shows unique centering, holding and driving mechanism.

How to cut a keyway in 1 minute with a *Minute Man* keyway broach kit

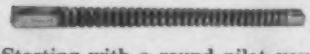
MINUTE MAN KEYWAY BROACH KITS come complete with broaches, bushings and keystock. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

1. Select the right size bushing for the bore (sizes are plainly marked).

2. Insert the right size broach in the bushing slot.

3. Place under an arbor press and press through.

SAVE TIME WITH STANDARD STOCK SQUARE BROACHES



Starting with a round pilot you can finish an accurate square hole in one pass in less than one minute. For 1/8" to 3/4" holes. Hexagon and round broaches also available.

The duMONT CORP., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square, Round and Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

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Company.....

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duMONT

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Vanishing Craftsmen

Dear Sirs:

As a craftsman in the metalworking industry for 20 years, I have seen first-hand why the craftsman is "Today's Vanishing American" (*AM/MM*—Apr 4 '60, p121). I feel that a lack of respect for the craftsman is a basic problem. If the craftsman was elevated to a professional level, economically and socially, equal to engineering or supervisory level, there would be less desire to switch to non-metalcutting jobs. The craftsman is the cream of the metal trades and should not be skimmed off to fill other positions. His position should be a goal and not a stepping stone.

The high requirement of abilities and qualities needed by craftsmen to perform their jobs, the long term of apprenticeship and experience gathering, and the pitifully small returns for the time and energy spent are deterrents to young people who may enter the trade. The pay in many industries, for less ability, is higher to start with and higher in the long run . . .

Give craftsmen the pay, respect, and professional level they deserve, and you will have competent men clamoring for jobs as craftsmen.

Arthur C Voegely
Syosset, NY

Dear Sirs:

. . . I would like to add one more reason to Mr Hyman's very valid list: the union influence . . . The strict seniority clauses negotiated by the unions [after the mid-thirties] began to require that newer employees be "bumped" regardless of skill or status.

Metalworking is a fluctuating industry. Hence the large plant, needing and able to staff and afford a craft in-shop training program, is unable to guarantee student tenure even for the duration of the program. It has been my experience that machine operator programs of a few weeks' duration are practical in a union shop. Craft apprenticeships of four years' duration are not.

This should not be read as an anti-union rebuke . . . However, I submit that the problem is of concern to the industrial unions which must advance their membership from semi-skilled to highly-skilled status or see that membership decrease as technology

SHOPMATES

N. Jarvis

MY MACHINE'S GONE!!
THEY JUNKED MY MACHINE — THEY'LL GET RID OF ME NEXT — OVER THE HILL AT FORTY TWO — WHAT'LL I DO?? WHERE'LL I GO ??!!
WE MOVE IT TWO FEET — HE CAN'T SEE IT THROUGH THE TEARS!
HE CAN'T SEE OUT OF THAT GROOVE HE WORE IN THE FLOOR!!
N. JARVIS

There's a WESPO clamp or plier for every clamping job!

80 models and sizes...

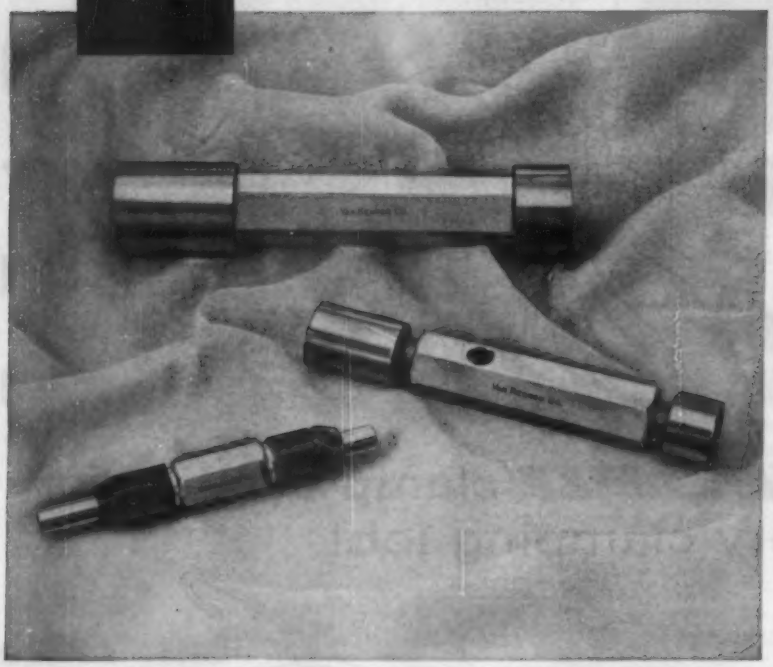
made better three ways to give more positive holding, last longer!

1 Reamed holes
2 Hardened serrated bushings
3 High tensile strength rivets

send for free catalogs describing Wespo clamps and fixture details

WESPO DIVISION
VLIER ENGINEERING CORPORATION
Formerly West Point Manufacturing Company
26935 W. Seven Mile Road • Detroit 19, Michigan

VK VAN KEUREN



For those who require precise measurements

VK

THE Van Keuren CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

advances. A cooperative effort by management *and* union would seem to be required to revive craftsmanship for the benefit of the individual, the organization, and society.

Robert C Lincoln, *industrial engr*
Arthur D Little, Inc
Cambridge, Mass

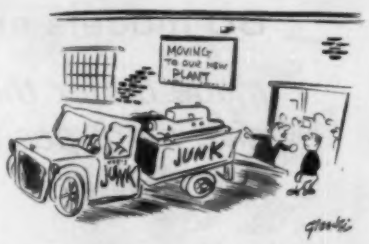
Dear Sirs:

. . . During the past 30 years as an industrial arts instructor in this city's high schools, I have devoted my time in a well-equipped machine shop endeavoring to encourage boys to enter apprenticeships to become craftsmen. I have been more successful than many schools in getting my boys placed and later seeing them develop into craftsmen. But they all tell what a struggle it was to keep headed in the right direction.

The condition was generally brought about by short-sighted engineering management. Training opportuntiies were slighted and production emphasized. Work units were broken down so a non-skilled worker could be short-trained to do one or more operations on automatic machines and was paid highly for his speed. Most often his pay was as high if not higher than the craftsmen who made his machines and tools possible.

. . . I claim that if you do not train craftsmen, the same as engineers and scientists, and elevate their standing, death and age will diminish the supply to a real danger point . . . It seems to me that a craftsman should be paid commensurate with his training and ability, the same as engineers, and above the scale for piece workers and other non-skilled workers.

Alfred Grayshon,
machine instructor
Olney High School
Philadelphia, Pa



"I don't care if he was low bidder on our moving job—buy him off and get someone else!"

CALENDAR

American Machine Tool Distributors Association—Annual Meeting, Sept 3-4, La Salle Hotel, Chicago, Ill.

National Machine Tool Builders Association—Machine Tool Exposition, Sept 6-16, International Amphitheatre, Chicago, Ill.

Production Engineering Show, Sept 6-16, Navy Pier, Chicago, Ill.

Coliseum Machinery Show, Sept 7-15, Chicago Coliseum, Chicago, Ill.

Society of Automotive Engineers—Farm, Construction, and Industrial Machinery Meeting, Sept. 12-15, Milwaukee Auditorium, Milwaukee, Wis.

American Die Casting Institute—Annual Meeting, Sept 14-15, Edgewater Beach Hotel, Chicago, Ill.

American Welding Society—National Fall Meeting, Sept 26-30, Penn Sheraton Hotel, Pittsburgh, Pa.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Sept 26-30, Coliseum, New York, NY

Pressed Metal Institute—Annual Meeting, Oct 10-14, Shawnee Inn, Shawnee on Delaware, Pa.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 10-14, The Ambassador, Los Angeles, Calif.

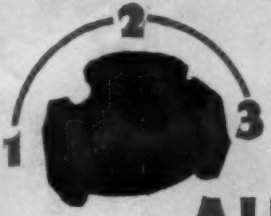
Industrial Management Society—Industrial Engineering and Management Clinic, Oct 13-14, Conrad Hilton Hotel, Chicago, Ill.

National Safety Council—National Safety Congress, Oct 17-21, Conrad Hilton Hotel, Chicago, Ill.

American Society for Metals—National Metal Exposition and Congress, Oct 17-21, Trade and Convention Center, Philadelphia, Penna.

National Tool & Die Manufacturers Association—Annual Convention, Oct. 19-23, Leamington Hotel, Minneapolis, Minn.

What is done is DONE... on the GOSS & DeLEEUW



AUTOMATIC CHUCKING MACHINE

There are no half-finished pieces lying around at the end of the day when you put your work on this outstanding machine.

The "1-2-3" feature—available only on the Goss & De Leeuw Automatic Chucker—provides the means of finish machining three ends of a part without changing set-up.

Note some of the typical parts machined. Ask for illustrated literature giving further details and send samples of your work for a cost estimate on handling it on the Goss & De Leeuw.

GOSS & DeLEEUW PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

JONES & LAMSON MACHINE TOOLS

the man who needs
a new machine tool is
already paying for it

Two-dimension tracing eliminates secondary operations and reduces costly "off" machine time

Two-dimension tracing, combined with conventional turret lathe tooling, provides an extremely versatile method for complete machining to tight specifications.

For instance, the end use of the connecting rod bolt (illustrated above) demands extremely fine finish to eliminate the starting of fatigue cracks. In addition, relief surfaces, O.D., head faces, and threaded end must all be square and concentric. Radii of fillets connecting the different diameters must be smooth and free from scratches. Two reliefs, each 6½" in length, must be held to + or — .002" and to 40-50 RMS to eliminate subsequent grinding operations. The finished parts are 19-3/4" long with different O.D.'s varying from 1-1/2" to 2-7/16". The material is tough: AISI 4140; Brinell 241.

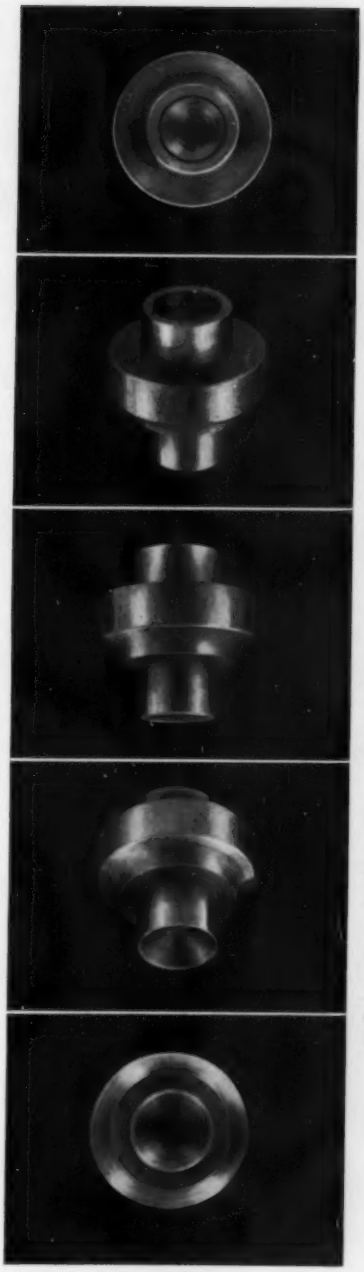
All this is accomplished in one tooling set-up on a J&L turret lathe with a two-dimensional tracer. Floor-to-floor time for finished parts is less than three minutes on the head end, and less than nine minutes on the shank end. Write for Folder #5903.

Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

The more stock you put in bar automatics, the more you should consider

BETH-LED



Part: Inner race for ball bearing

Screw stock: 7/16-in. BETH-LED round

Chip removal: 60 pct

Cutting speed: 286 SFM —up 29.5 per cent*

Production rate: 1800 pieces/hr—up 20 per cent*

*over the control stock: C-1213 non-leaded steel.

Steel

for strength
. . . economy
. . . versatility

Your profits go up when you switch to Beth-Led, Bethlehem's newest free-machining steel. This high-sulfur, leaded carbon screw stock has proved its ability to trim costs—by speeding metal removal and lengthening tool life. Chip control is excellent; machined surfaces are smooth as silk.

Give Beth-Led a trial and you'll be convinced. It's available either hot-rolled as produced by Bethlehem, or cold-finished as distributed by non-integrated cold drawers.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

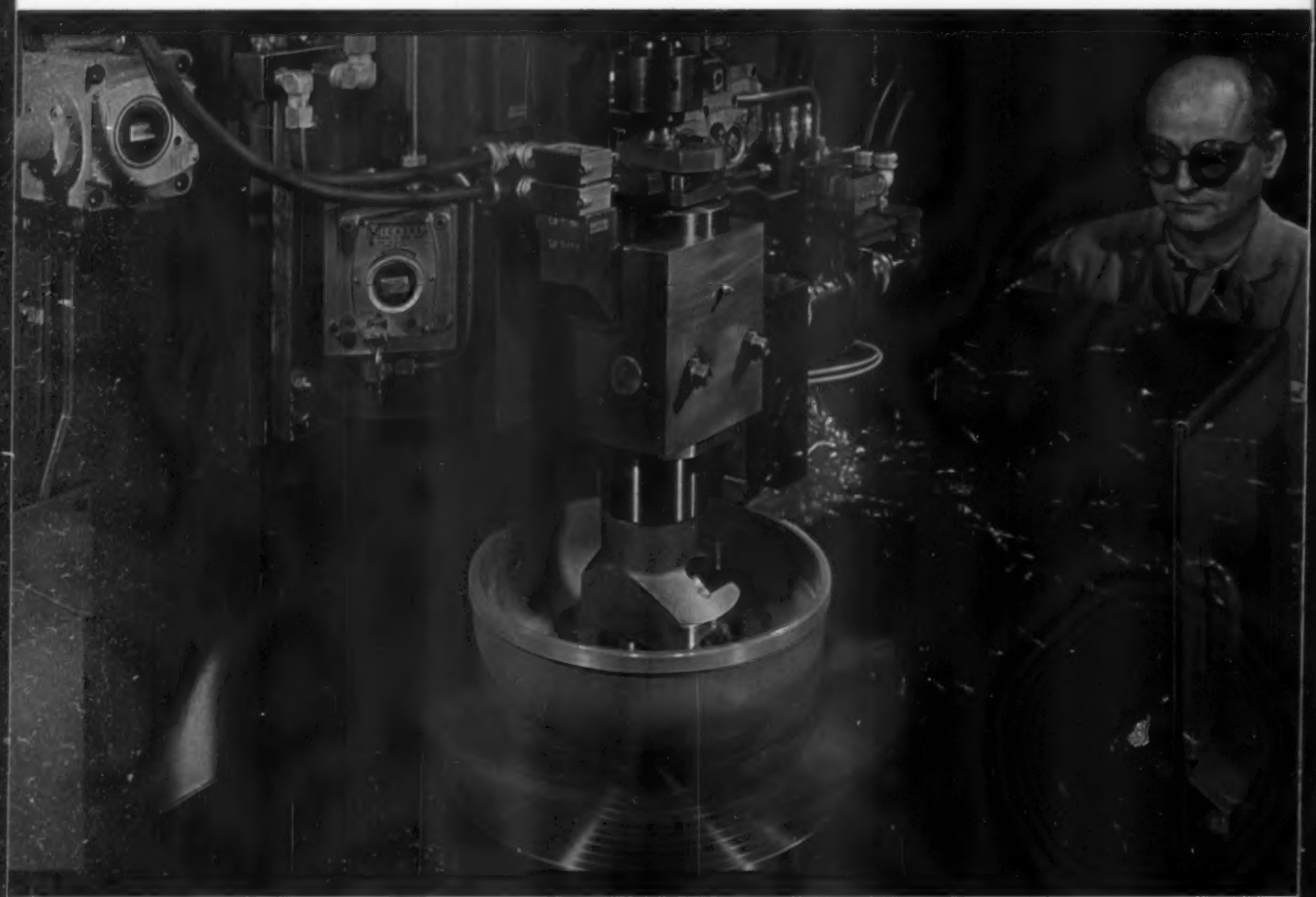
BETHLEHEM STEEL

BETHLEHEM STEEL

CIRCLE 220 READER SERVICE CARD

CIRCLE 221 READER SERVICE CARD ►

introducing a dramatic new concept in metal chip removal MOTCH and MERRYWEATHER



CUTTING POWER ON COMMAND! Each Vertical Turner is engineered to your specifications from *production-built* low-cost components. Initial machine costs are slashed! Costs of parts made with this tool are cut in half and more!

Never has there been a machine tool which has met with such immediate enthusiasm by production men. It provides utility and productivity in a versatile package to fit your specific turning, facing, tracing, and boring needs!

Check these sensational cost-cutting advantages and features and phone our distributor today for an appointment to see and learn more about this revolutionary new machine tool. We'll be happy to show you how to replace obsolete metal-cutting machines — *profitably!*

Time comparison on machining motor end bells at Electra Motors, Anaheim, California.

OLD WAY

Part A-8274 (Frame 284 and 286)

Operation #1 — chuck on motor bosses in 4-jaw chuck:
Rough turn 13" Dia. O.D.
Rough bore to 3.936 Dia.
Fin. bore to 7.040 Dia. — Time: 3.7 min.

Operation #2 — Reset tools:
Fin. turn 13" Dia. O.D. — Time: 1.7 min.
Fin. bore 3.9369 Dia. — Time: 6.2 min.
Total Time: 11.6 min.

NEW WAY

A Motch-Merryweather Model I-V Vertical Turner does all of these operations at one chucking and in one continuous cycle in 46 seconds!

Vertical Turner

MODEL 1-V
ILLUSTRATED

- RIGID CAST COLUMN HOLDS TOOL POSITION ACCURATELY
- ALL HYDRAULICS EXTERNALLY MOUNTED
- TOOL SLIDES MOUNTED ON HARDENED AND GROUND WAYS
- TOOL POSITIONS EASILY CHANGED
- TREMENDOUS TURNING POWER AT THE SPINDLE SPINDLE RUN-OUT HELD TO .0002"
- HAND-HIGH CONTROLS
- PUSH-BUTTON CHUCKING
- CHIPS STAY CLEAR FOR EASY REMOVAL
- SIMPLE, AUTOMATIC, SEQUENTIAL PROGRAMING
- BASES OF HEAVY INTERNALLY-RIBBED CAST IRON OCCUPY 50% LESS FLOOR AREA
- ALL COMPONENTS CAN BE ASSEMBLED AS DESIRED OR CHANGED AT WILL

MOTCH AND MERRYWEATHER

1250 East 222nd Street CLEVELAND 17, OHIO

NEW TOOL STEEL SERVICE

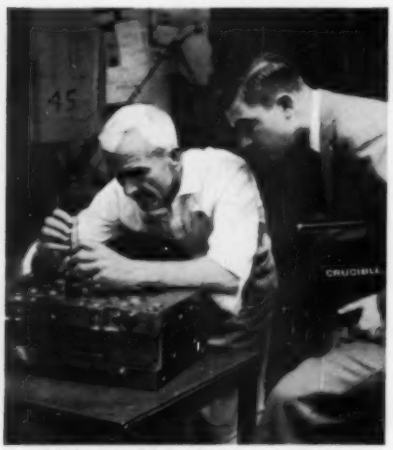
helps you estimate costs more accurately!

Estimating tooling costs, especially on new jobs,

becomes more accurate and profitable with Crucible's new Tool Steel Service.

This service enables you to use fewer grades of tool steels...

which you get to know inside-out! So, you can more accurately predict



machining and bench time, and response to heat treating.

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CIRCLE 223 READER SERVICE CARD

SPOT NEWS...

- **A columbium alloy five times as resistant to oxidation as pure columbium,** and about 100 times as resistant as molybdenum, has been developed by Thompson Ramo Wooldridge and DuPont. The 80-10-10 Cb-Ti-Mo alloy, designated D-31, shows a tensile strength of 100,000 psi at room temperature, 24,500 psi at 2000 F in air.

- **Where is the Russian automation that Moscow has been bragging about?** Delegates to the International Federation of Automatic Control report seeing no sign of program-controlled machines in the several Leningrad plants toured. Top plant engineers did say however that continuous control systems are planned for next year's production.

- **Metalworking industries will invest $1.505 billion in machine tools** (both metal-cutting and metal-forming types) by the end of 1961. Source of this encouraging figure is an extensive survey just completed by AM/MM. An average of $79,000,000 a month will be spent on machine tools during the 19-month period between June 1960 and December 1961. For further details, see p95.

- **Ford's compact-compact, the Cardinal-A, will be ready early in 1962.** The design calls for a conventional front engine, rear-wheel drive, and 85-in. wheel base. Another small car, about the size of a Comet, is to be introduced at the same time. Its code name is Canadian-X. Because of the success of the present T-bird design, plans for front-wheel drive have been shelved for the 1961 model.

- **Israel is planning a $550,000 tool and die plant** which would cover the bulk of local requirements and allow exports to the US. About $350,000 in foreign currency is needed along with a number of foreign specialists for the project. It is thought that exports to US will be possible because Israeli tool and die manufacturing costs run $3 to $5 per hour less than American costs.

- **Graphite ceramics are about twice as strong as standard graphite** at room temperature, reports Boeing Aircraft. These ceramics, containing titanium boride and molybdenum disilicide, develop a self-healing protective coating when heated in air above 2000 F. Materials now being tested contain about 50% graphite, 25% of each of the other materials.

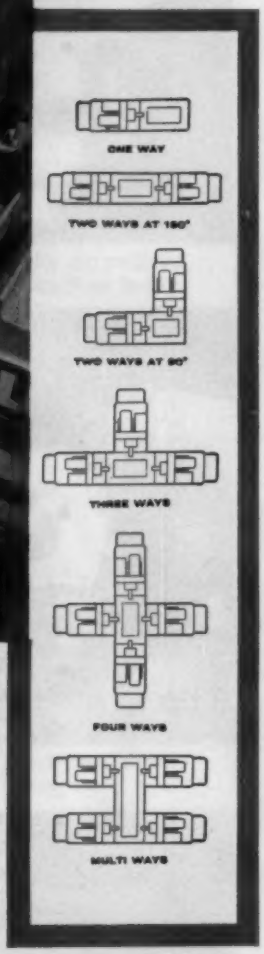
- **Japanese bearing exports continue to boom with large orders from the US.** Fujikoshi Steel Co, one of Japan's big five bearing manufacturers, has just clinched orders with General Motors, General Dynamics, and General Electric totaling $280,000. A West German manufacturer is buying $140,000 worth a month.

- **General Motors has bought the former naval arsenal at Warren, Michigan,** for $3.5 million. Built by the government for $30 million during World War II, it will now be used to manufacture Chevrolet parts. Last occupied by the Ford Motor Co, the plant has been vacant since 1956.

- **A $10.8-million machine tool factory now being built in Poznan, Poland,** is scheduled to start operation in 1963. The plant will produce 2,000 turret lathes and 350 automatic machine tools annually.

- **Rocket engine that can be turned off and on at will to control spacecraft** position and flight direction has been developed by Bell Aerospace Corp. Engine is an advanced version of the model used in the current Discoverer satellite vehicles. Development should eliminate the weight penalties and complex controls associated with multi-staging of missiles.

TYPICAL "BUILDING BLOCK" ARRANGEMENT



4-Way Production Savings with Ex-Cell-O Way Machines

1 LOWER COST Each Ex-Cell-O "Building Block" Way Machine Unit has standard base, table slide and complete, inbuilt hydraulic system. You can specify only the standard spindles or accessories that meet your present needs. **2 INCREASED FLEXIBILITY** One Way-type unit gives you a basic, versatile precision boring machine; as operations become more complex, simply add one or more Way units to a common end section to multiply production or machining functions. **3 MORE VERSATILITY** Ex-Cell-O Way Machines permit precision boring, turning, facing or grooving, chamfering or counterboring—with or without automatic cycles, work indexing or clamping. **4 GREATER CAPACITY** Using simple fixtures, you can rough or finish-machine larger, heavier work than possible on most standard boring machines.

Ask your Ex-Cell-O Representative about savings with Way-type Machines, or write direct for details.

SEE EX-CELL-O'S BOOTH 946, NMTBA EXPOSITION

Typical setup shows four units positioned at 90° for simultaneous rough boring, counterboring and trepanning. Beds, tables, center section, hydraulic systems, controls and Ex-Cell-O Precision Spindles are standard components. Units can be rearranged at any time.

60-29

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CIRCLE 224 READER SERVICE CARD

WASHINGTON...

Step-up in defense orders...

You can expect a heavy flow of new military contracts in the next three months before the presidential elections. This period is normally a relatively quiet time for new defense business. But this year a much larger volume of new orders than is usual for the period is expected. Political motives are obviously involved.

Pentagon insiders say this is what happened in 1956, and this is what they are anticipating once again.

No written directives were involved four years ago; just a few Pentagon phone calls to key procurement agencies in the field. Contracting officers were given the green light on big projects which ordinarily would have been bogged down for months in the Defense Department's chain of command.

Congress votes more for defense...

The new defense appropriation comes through the Congressional wringer in final shape with $700 million extra tacked on for R&D and production contracts. This is far below the $2-billion and $3-billion budget increases Democratic leaders were talking about right after collapse of the Paris summit talks.

Among the major increases: $190 million added to the $85-million fund for B-70 development (enough to resume work on cancelled subsystem projects); $241-million to the $1.5-billion request for Polaris submarines and missiles (enough for two extra vessels); $83.8 million extra for development of the Minuteman missile and Midas and Samos satellites; and $332 million tacked on to the Army's $1-billion procurement budget.

But on the other side of the ledger, Congress approved a 3% cut in each procurement appropriation. This amounts to a total reduction of some $400 million. Purpose is to force "economies" in individual military contracts—that is, put a crimp in contractor pricing and profits. But Pentagon fiscal experts warn that the major effect will be to trim back the quantities of materiel to be bought.

At first, the Eisenhower Administration was cool about spending the extra money. Now Defense Secretary Gates implies some of it will be used. Most likely beneficiaries: the military satellite projects and Army procurement. The Eisenhower Administration's decision on the increased budget may be academic; it's not unlikely that the man who takes over the White House in 1961 will switch signals on current Pentagon spending plans. The Democrats are committed to this; Nixon, the Republican candidate, is more favorably disposed to expanding defense outlays than Eisenhower has been.

Defense buying policy...

Among the issues awaiting legislative action when the Senate reconvenes in two weeks is the controversial question of military procurement policy. It figured in seven Congressional investigations this session.

In the rush to get out for the convention recess, the House passed a bill, introduced by Rep Vinson (D-Ga) aimed to (1) spur more formal advertised procurement and less negotiated contracting by the military, and to (2) clamp down on profit allowances and excessive cost estimates in incentive-type contracts.

The outlook for Senate passage of the bill is uncertain. Though there is little if any opposition to the measure, there is also not enough push to assure that the Senate will even get a chance to vote on it.

Key provision of the Vinson Bill is a proviso that target prices on incentive fixed-price contracts be readjusted before final settlement between the contractor and procurement agency.

Other provisions in the Vinson Bill—knocking out certain legislative authority for negotiated procurement and requiring contractors to "certify" cost estimates—are less significant. The procurement law contains other provisions authorizing negotiations rather than formal advertising on contracts. The Air Force recently called for certification on cost estimates in its own administrative regulations.

Top defense contractors...

General Dynamics was top defense contractor in 1959 with $1.5-billion worth of new orders, 6.9% of the total awarded. The company was second leading contractor in 1958.

Boeing, number one in 1958, slipped to second place in 1959. It racked up $1.2-billion worth of new prime contracts last year, 5.4% of the total.

Other companies in the Pentagon's top ten, in order: Lockheed, North American Aviation, General Electric, Martin, Douglas Aircraft, United Aircraft, American Telephone & Telegraph, and McDonnell Aircraft.

Sixty-four of the 100 top contractors are in aircraft, missiles, or electronics; ten are oil companies, eight are in construction, and five in shipbuilding.

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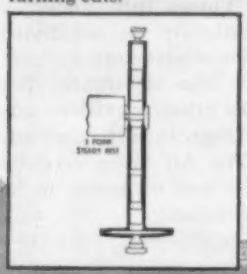
MULT-AU-MATIC TYPE "L"

Over the years, many improvements in design and engineering have been incorporated — until today — the Bullard Center Turning Mult-Au-Matic, Type "L" is built to produce for your highest productivity and efficiency.

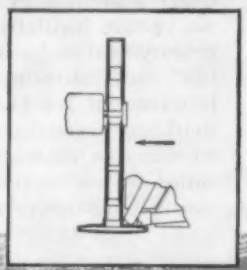
This machine is available with 6 or 8 spindles, single or double index, with either 10" or 14" diameter chucks. Spindle speeds of 56 to 1250 R.P.M. can be furnished and individually selected for each working station. Feed rates, between .0025 and .0625, can be individually selected for each working station.

Thus, to insure maximum productivity of the machine, you have individually selected spindle speeds and tool feed rates at each station. Further, it permits the use of modern cutting tools, methods and materials which also contribute to reducing your machining costs.

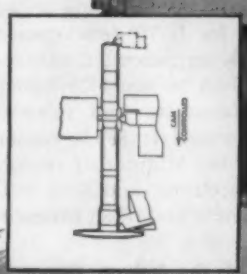
Prior to the Bullard operation, pieces have been center drilled at both ends and steady rest spot ground to support the shaft during turning cuts.



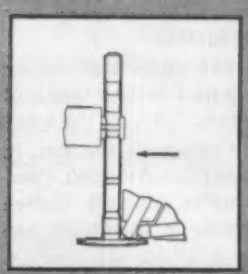
STATION 1 Loading and unloading.



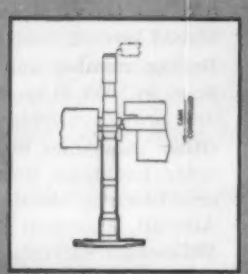
STATION 2 Rough facing of flange.



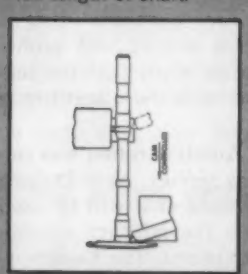
STATION 3 Rough turning of stem diameter — full length of shaft.



STATION 4 Finish facing of flange.



STATION 5 Finish turning of stem diameter — upper part of shaft.



STATION 6 Finish turning of stem diameter — lower part of shaft.

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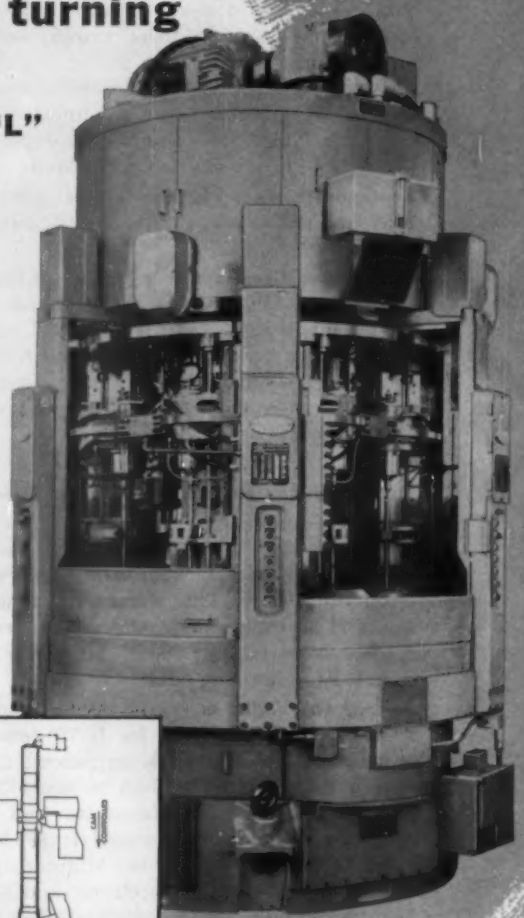

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DETROIT...

Monkey business...

Closure of Peninsular Metal Products Corp, a large Detroit-based supplier of automotive brightwork, adds one more name to a long list of midwestern suppliers who have found it unprofitable to do business with the auto industry. It also adds 500 persons with upwards of 30 years service to the roster of Detroit unemployed, with nothing to show for their loyalty but $23 for each year of service.

Hardly a main thoroughfare in this city is without a cavernous, multi-story factory standing in broken-windowed testimony to the sharpness of automotive purchasing agents. The once neat homes surrounding these are run-down beyond repair, and only those stores which accept welfare script in return for necessities have survived.

The roll call of companies which have withdrawn from the manufacture of original equipment for motor vehicles is indeed impressive—and sobering. Included are Briggs, American Foundry, Murray Corp, Vinco and Pressed Metals of America. Midland-Ross, Gemmer, and Ainsworth are down to a fraction of their former automotive volume.

An equally long list of companies have pulled out of the midwest for the south, where wages average 65 cents an hour below the normal UAW-CIO scale. Electric Autolite, for example, is shifting the bulk of its automotive parts production from Toledo to a new $6-million plant in Decatur, Alabama.

Most common method of survival is diversification to the point of divorcement. Motor Products Corp found its back to the wall four years ago due to the industry trend towards make rather than buy. Since then it has entered the parking meter, water pump and winch businesses, and is engaged in research on rare earths and electronic products. The company is once again in the black.

Based on a weighted average of $1200-worth of materials and components in a passenger car, the auto industry theoretically pays out a staggering $7.2 billion annually for ingredients. Of late, however, nearly 50% of the Big Three's share of this figure has been paid in paper transactions, each to themselves.

Ford Motor Company manufacturing units make a net of $90 for the manufacture of materials and components for each Falcon, and some 30% more than this figure for standard-sized Ford products. American Motors, on the other hand, has earned undying supplier loyalty through its firm policy of depending upon the outside for most everything.

Supplying auto companies is a highly competitive (some call it cut-throat) business, and only the most adept organizations survive. The picture is further complicated by sporadic instances of out-and-out nepotism. As one supplier executive put it, "we like to do business with auto companies, but 20% of our capacity is about all we will risk. Any further expansion is welcome, but only within this ratio."

Let the inventor beware...

Examples that are the opposite of what is normally considered not only loyalty but just good business are legion. An instance involved a supplier of seat frames to a Big Three manufacturer. This company suggested a standard frame that could be used by all makes within the auto family in question, rather than a costly separate frame. The customer accepted the idea (and blueprints) but the order went to a competitor.

An invention, such as an automatic transmission or a new type of power-actuated front seat, is hazardous to bring to the attention of the Big Three. The best a supplier can expect is an exclusive for a year. Then, if the item is good enough, he may join the purchasing auto company as a 50% supplier the next year. Beyond that, he has no rights, despite the popular assumption that patents offer protection.

Most surviving suppliers figure that they must come up with something new every year to make up for the theft of last year's idea. But complicating this is the so-called NIH (not-invented-here) factor. Simply put, engineers of the auto companies find themselves on the spot when a supplier comes in with a really fresh idea, particularly when they have been researching without results the same approach themselves. What often happens is that the supplier is talked into showing blueprints, and, after several months, finds something remarkably similar appear in production without so much as a curtsy.

Some items are at least temporarily exempt. Wheels, for example, can be made for a variety of cars from the same basic die. Thus a supplier can do the job cheaper and is in a fairly secure position. Another item historically bought on the outside is the radio. So once, though, were carburetors and even engines. Nothing seems to be sacrosanct against make or buy in the long run—**Don MacDonald**

it took 35 seconds and 52 years to process this Diesel engine block

And 52 years? Yes, that's how long Greenlee has been building automatic transfer machines. In these years we have helped solve hundreds of widely diversified problems in automatic production. This experience has won exceptionally wide recognition in the automotive industry. That's why much of our business is repeat business from satisfied customers. If you haven't yet worked with us, now is the time to call. We stay on the job all the way . . . from the time of initial planning until the machine is operating at full efficiency.

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CIRCLE 226 READER SERVICE CARD

AIRCRAFT and MISSILES...

TRENDS

Aerospace Corp organized...

The Air Force's new contractor for scientific planning and management of missile and space projects, the Aerospace Corp, has opened up shop. The new organization will be housed in the El Segundo, Calif, facilities now used by Thompson Ramo Wooldridge's Space Technology Laboratories. Dr Ivan A Getting, formerly vice president for research and engineering at Raytheon, has been named president of Aerospace.

STL will continue as systems engineer and technical director for the Atlas, Titan, and Minuteman missile projects. Aerospace will take over STL's function in advanced systems analysis and planning, research, and experimentation on other projects.

Included are advanced ICBMs and anti-ICBM systems, project "Saint" (satellite interceptor), advanced re-entry vehicles and penetration aids, new propulsion and guidance systems, satellite communications systems, and manned space systems.

There will be a key difference between what STL has done in the past and what Aerospace will do:

Beyond the experimentation stage, Aerospace will be in charge only of what the Air Force describes as "initial" systems engineering and technical direction. "Detailed" development systems engineering and technical direction, the controversial role which STL also held, will be farmed out to prime production contractors. But Aerospace, like STL, will play an important part in evaluating contractor proposals to the Air Force in missiles and space fields.

Feud over satellites...

A serious State Department-Defense Department squabble has broken out over the Air Force's program to develop the Midas early-warning and Samos reconnaissance satellites. A top-echelon Defense Department official complains that State Department "interference is holding back work" on the projects.

Officials hesitate to talk about the issue. But this much is apparent: State has insisted on restricted orbits for the first few test shots to avoid going over Soviet territory. It is also trying to restrict equipment specifications for ground tracking and computing facilities—and also, apparently, for apparatus inside the prototype satellite models. A plan to set up special antennas in Pakistan, for instance, to read out satellite signals has been shelved.

State's motive is obvious: It wants to avoid another U-2 incident in the near future. But Pentagon R&D officials are furious, dismiss State's fears.

NASA officials also complain about the influence of the State Department in the planning of the nation's space program.

A new look in strikes?

One of the most interesting development in this year's labor-management clashes in the aerospace industry is the growing importance of the technicians working at the satellite and missile testing and firing stations.

For the first time, their problems and gripes outweighed the problems of the workers at the home plants. And the IAM, for the first time, made these outside-the-plant technicians its key bargaining weapon.

Both union and management officials agree that the field workers' problems will become even more important in the future as more and more technicians are assigned to such bases.

B-70 could replace the U-2...

The B-70 bomber could take over the high-altitude spy role of the old U-2 and use only United States bases. This versatility of the B-70 was noted in a report released by Senate Majority Leader Johnson as chairman of the Senate Preparedness Committee.

The B-70, said Johnson, will be able to attain an altitude of 80,000 ft, fly about 2000 mph at that height and have a range of about 7000 miles. Congress has voted extra funds for the B-70, but the Defense Department has indicated it may not use the money for that purpose.

Temco Aircraft merges ...

Temco Aircraft Corp, Dallas, has merged with Ling-Altec Electronics, Inc. Under merger terms, Temco has been dissolved and all its assets sold to the new company, Ling-Temco Electronics, Inc.

Temco will function as a subsidiary of Ling-Temco under the name Temco Electronics & Missiles Co. Merger, in the works for the past several weeks, results in a company with combined assets of over $67 million.

Robert McCulloch, former Temco president and now board chairman and chief executive officer of Ling-Temco, said his old firm's financial position would not permit it to develop its own missile and space program alone. "We are in effect buying time, and we made the best deal we could," he told stockholders.

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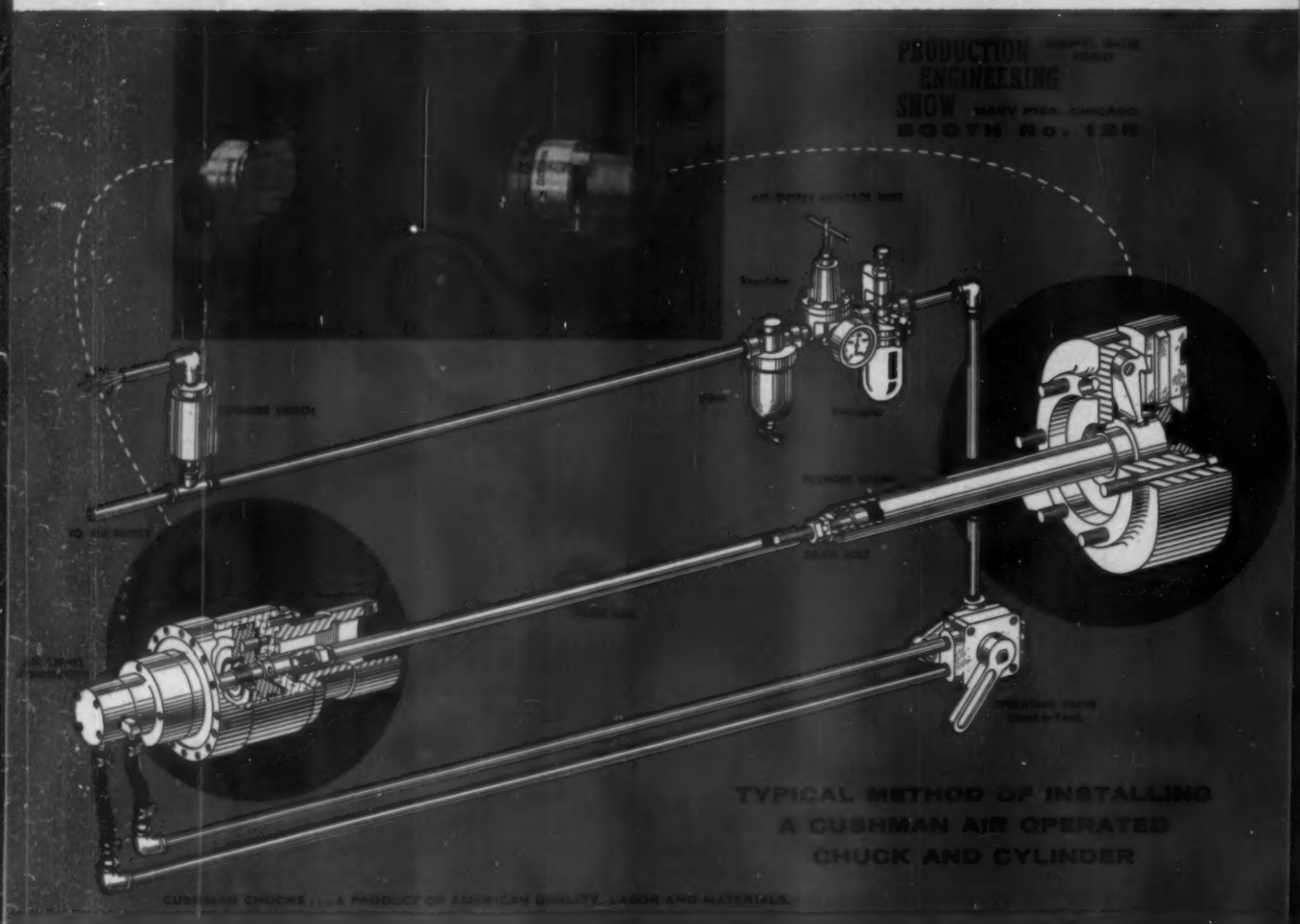
AIR OPERATED CHUCKING EQUIPMENT



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MACHINE TOOLS...

Soviet to use gear transfer unit...

A transfer machine for manufacture of gears, performing all operations from the rough forging to finished gears, is being built by the Russians for use in their lathe building plant at Moscow.

This report comes from Ralph J Kraut, president of Giddings & Lewis Machine Tool Co, Fond du Lac, Wis, who recently returned from a visit to Moscow. Mr Kraut saw the machine in process of manufacture at ENIMS, Soviet machine tool research center.

ENIMS develops new types of machine tools, builds prototypes of new machines, and sometimes makes the first batch of a new type of machine. It also is charged with responsibility for approving designs of new machine tools, or improvements of existing models, developed by Soviet machine tool building plants. These plants cannot put the new designs into production until ENIMS approves.

Another responsibility of ENIMS, Mr Kraut points out, is to test any type of non-Soviet machine tool that Russian plants may wish to import for their own use. (Editor's note: Some U S and European builders charge that Russia often buys only one of a certain type of foreign tool so that ENIMS designers can copy it for Russian production.) The transfer machine for gear production, Mr Kraut avers, is several hundred feet long. It incorporates hobbing, internal grinding, tooth rounding, shaving and heat treating among its operations.

ENIMS also is building spiral bevel gear generating machines of its own design.

Skillful use of labor power...

Mr Kraut said that the Soviet, more than any other European nation, is using a combination of brainpower and brawn and has been successful in almost doubling its available labor power by skillful employment of women. He was impressed by the seriousness and dedication to their jobs of the Russian people.

Going into Russia shortly after the Summit fiasco, Mr Kraut found no resentment against the American people. He was greeted in friendly fashion everywhere. He stood in a queue of Russians almost a mile long to see the public exhibition of the U-2.

Among Mr Kraut's observations are these: 1) never has he seen so many people on the sidewalks and in the streets as in Moscow, perhaps partly because living quarters are so crowded that it is natural for people to get out and wander; 2) automobile traffic jams in Moscow, which has unusually wide streets, are as great as in any other of the world's large cities; 3) the exhibition for economic progress, occupying 67 big buildings in a Moscow park, is a sort of a permanent world's fair and is breath-taking in its scope; 4) whereas the top ministries used to make all decisions relating to industry's needs, this task is now decentralized and people doing business with Russia should bear this in mind.

Cross bids on Soviet order...

The Cross Co, Detroit, has bid on a prospective order from Russia for transfer machines for automobile engine production totaling close to $6 million. Washington has given its official blessing to this transaction, as reported on this page in the June 27 issue, by granting an export license to Cross to ship the machines if the order is obtained. This means that in the federal government's eyes, the machines have no military value.

United Automobile Workers put a bizarre aspect on the possible transaction by announcing that it has asked Soviet premier Khrushchev not to do business with Cross until the dispute between Cross and the UAW is settled.

Far more to the point, Cross will have stiff competition from European companies in getting this sizable order. At least one German builder and a prominent British builder are known to have put in bids. Both companies have shipped machines to Russia the past few years.

Western European builders have been supplying Russia with transfer machines for some time. A well-known German builder has devoted a fair portion of its plant to transfer machines for Moscow for the past year or longer. Renault in France is about to ship a transfer machine to Russia that its machine tool building division has just completed.

European builders who have been dealing with the Russians say that they are as tough as ever to do business with. Stankoimport people, who buy all machines imported into Russia, are acknowledged to be competent but are adroit bargainers about terms and conditions of purchase and delivery. They raise the blood pressure of suppliers by frequent changes of design specifications and by rigid inspection tests prior to acceptance.

BF

"Two metalworking machines for the price of one?"

"I didn't believe it until a Ryerson machinery specialist showed me how.

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Why not have Ryerson study *your* machinery requirements? You'll get unbiased recommendations and a choice of 2800 different pieces of metalworking equipment. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Illinois.

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TRENDS

MATERIALS...

"Coherent light"...

Man, for the first time, has developed a technique for amplifying light. This technique is not just increasing the power to the light source but, instead, taking a ray or beam of light from any source and passing it through an amplifier which increases its intensity by many hundreds or thousands of times.

Developed by scientists at Hughes Aircraft Co, Culver City, Cal, the device is called a "laser." This name is an acronym derived from the first letters of the phrase, "Light Amplification by Stimulated Emission of Radiation." The laser is sometimes called an "optical maser," as the *m*aser is more familiar for *m*icrowave amplification.

For industrial, chemical, and medical purposes, the laser will provide light concentrations and intensities never before obtainable. Called an atomic-radio light, the beams can be "brighter than those of the sun or stars, even at their hottest centers." Eventually, the technique may revolutionize interferometry and optical tooling techniques. As a communication advance, the laser projects the radio spectrum into a range 10,000 times higher than presently exists. One anticipated use is a as a "light radar" to direct light waves to a target, even in outer space, to reflect back, a super-clear "picture" never before attainable.

No larger than a glass tumbler, the laser has, at its heart, a pencil-thick synthetic ruby crystal, which is irradiated by a light source such as the powerful flash-tube lamp used for strobe photography. The optical (light) energy from the flash tube excites the atoms in the crystal to a higher energy rate. This action reradiates light energy entering one end of the crystal as random frequencies out of the other end of the crystal in an intensified coherent band of frequencies, or even as a single frequency.

Tool steel selection...

Allegheny Ludlum has developed a new concept in tool steel marketing. Designated the "Steelector Program," the plan is aimed at simpler selection of the proper analysis for a given requirement. Consequently it will reduce the size of inventories normally carried to meet various demands.

Although A-L will continue to make its present 150 grades as well as develop new ones, the study which led to the Steelector Program showed that 96% of all tool-steel applications can be adequately handled by only 18 tool-steel grades. The plan is based on eight all-purpose or toolroom grades; five high-speed grades; and five hot-work grades.

Special Steelector charts have been prepared to show the five common characteristics of each grade: red hardness, abrasion resistance, size stability, toughness, and machinability. Thus, the user can select a specific grade by comparing values for the most important properties required by the job, without losing sight of the secondary characteristics.

Boron isotope improves stainless...

For nuclear shielding and control rods, boron-containing stainless and mild steels are getting considerable attention. The problem of providing both high neutron absorption and good mechanical properties in the same steel has been solved by The Carpenter Steel Co with a new Type 304 stainless containing 0.2% of the boron-10 isotope. The steel has essentially the same nuclear properties as Type 304 with 2% natural boron. However, it has much better mechanical properties and corrosion resistance. They approach the properties, in fact, of the basic alloy.

If greater neutron absorption is needed than that obtained with 2% natural boron, the producer can supply all that is necessary by adding up to 2% of boron-10 isotope (enriched boron). This increase, though, will lower the mechanical properties of the alloy.

Oxygen facilities expanded...

Scheduled expansion of facilities, owned by the Linde Co, Div of Union Carbide Corp, at 16 locations throughout the country will increase by more than 20% the total presently installed oxygen capacity in the US. Most of the new capacity will serve the rapidly growing needs of steel producers. Point-of-use plants, either on-site or over-the-fence, will take about $50 million of the total program.

Owned and operated by Linde, these plants do not require any capital investment by the customers they serve. These customers include Bethlehem Steel Co, National Steel Co, Republic Steel Corp, US Steel Corp, Detroit Steel Corp, Armco Steel Corp, and Colorado Fuel & Iron Corp. Nearly 100 companies are now in the very active competition of producing oxygen. Some of the on-site oxygen plants may also produce argon, which is needed in increasingly larger volume for welding and working various alloys.

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Whether you are grinding a range of bearing races involving one shape in various sizes, or parts which involve a complete change in configuration — for example, from roller bearings to ball tracks — the versatility and tailored tooling of Bryant Internal Grinders assure you of record production rates and consistently high quality.

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WHAT'S AHEAD... in Metalworking

TRENDS

Some bright spots in summer outlook...

Though most metalworking companies report business steady at the normal summer levels, there are a few bright spots appearing. One of these is the major home appliance industry.

After a very rough first half, the appliance industry begins to see signs of strength. Though there are still soft spots, a definite upturn has been noted in the last few weeks. The heavy inventory is expected to adjust itself in the next 60 to 90 days.

Steel producers now feel that August will bring only moderate improvements. But things should really get rolling after that, what with the auto makers scheduling an all-time production high for October (*AM/MM*—Jul 11 '60, p89).

Sales of small and fractional-hp motors are running about 10% ahead of last year, and the outlook is for 10% gain for the year as a whole. Some manufacturers see a leveling off early in the fourth quarter, and feel that this will carry over to the first quarter of 1961.

Electrical machinery builders report steady business slightly above July of last year. 1960 is expected to equal, or exceed slightly, 1959's record. Industrial equipment is the strongest market currently; farm and construction markets have weakened considerably.

Plumbing supply manufacturers expect 1960 to show considerable improvement over 1959. Business at the moment is better than at this time last year. Prices have gone down on welding fittings, tubing, and fixtures, but are expected to increase on steel piping.

Industrial Heating Equipment Association now expects 1960 sales to fall below the $107.2-million level of 1959. Spokesmen for the Association won't talk about 1961, say they are baffled about the outlook. Sales for the rest of this year will fall far below the comparable period last year.

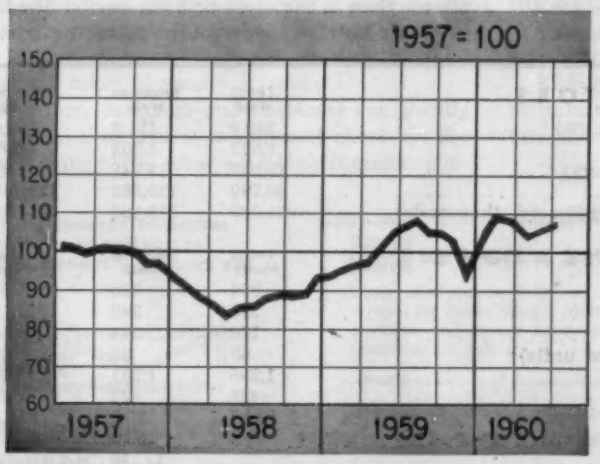
Automotive parts producers don't feel that the fourth quarter pickup will be enough to offset the rough second and third quarters. So, despite a good level of ordering from Detroit, it looks like 1960 will fall short of 1959 business levels.

Fastener shipments in the latest month held steady at an index mark of 92 (1956-58 = 100), considerably off from 119 last year at this time. Outlook is for business to be down 10% from 1959. Meanwhile, the value of fastener imports into this country during the first four months of 1960 increased 28.3%, and foreign competition is on the rise.

Radio and TV sales are up 11% and 16%, respectively, over last year. For the year, TV is expected to show a 5% increase, radio a 21% increase.

Materials handling equipment manufacturers continue to experience their best sales in many years. Several manufacturers expected healthy increases over 1959 business, and 1959 is looked upon by many as the best year in ages for the materials handling industry.

Producers of screw machine products report no pickup in activity. Third quarter production has dropped almost 20% in some cases, with no expectation of any sharp climb in the near future. For the year as a whole, producers forecast sales equal to 1959 at best. Other estimates run as far as 15% below last year.

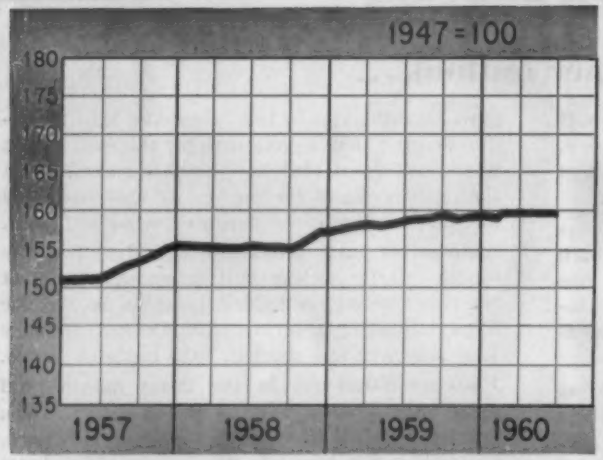


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUN. Estimated	MAY Preliminary	APR. Revised	MAY Year Ago
Total Index	**108**	**107**	**106**	**107**
Machinery	103	102	101	
Electrical Machinery	115	114	107	
Autos	121	115	111	
Other Transportation	92	89	97	
Other Metalworking	109	106	109	

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APRIL Revised	MAY Year Ago
Total Index	**159.9**	**159.7**	**159.8**	**159.2**
Metalworking Machinery	**191.2**	**190.4**		**184.9**
Other Machinery exc. Electrical	**173.1**	**173.0**		**169.6**
Electrical Machinery	**160.8**	**162.2**		**160.4**
Fabricated Metal Products	**147.8**	**147.9**		**148.8**

The trend in consumer prices...

Consumer prices and inflation generally are sure to be an important topic of political discussions in the coming political campaign. The consumer price index—the measure of the consumer price level—has increased considerably since the beginning of the year, and is currently at a new record-high. So the issue will be a timely one.

To keep the record straight, here is a brief rundown of the postwar trend in consumer prices accompanied by an outlook for the near future.

Consumer price increases since the end of World War II have been substantial. Since 1947 the overall level of consumer prices has increased by almost a third. During this period, prices of food have risen by about 25%, while prices of consumer durables have increased a comparatively modest 18%.

But sharpest increases have come in the prices of consumer services—rents, medical attention, commuter fares, for example—which account for just about a third of all consumer expenditures. Since 1947, rents have risen by 50%; costs of medical attention are up by more than 70% and costs of transportation services have more than doubled.

Looking into the future, prospects are that there will be far less inflation in the years ahead than we've had in the postwar period to date.

Prices of durables and other manufactured goods will be held down by a combination of factors. Recent outlays for research and development by industry should produce new processes that will increase productivity and offset wage increases in the future. In addition they should produce new products that can replace older, costlier ones. High productivity in agriculture should insure an ample food supply at stable prices.

And in the important area of services, the outlook is for greater price stability, too. In most areas of the country, housing is more readily available than in the early postwar period. Rents thus won't be rising as rapidly as in the past.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	149.0	151.4	157.4
Steel ingot production (thousand tons)	1,513	1,203	1,097
Electric power output (million Kilowatt hours)	13,031	14,247	13,502
Production of automobiles	90,799	125,868	123,147
Engineering construction awards (Eng. News-Record, thousands)	601,087	518,700	446,529

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	294	338	301
Vacuum cleaners sales (thousands of units)	278	340	317
Washers sales (thousands of units)	176	244	278
Household electric ranges sales (thousands of units)	68	86	80
Radio production (thousands of units)	1,290	1,361	1,040
Television production (thousands of units)	425	422	389
Gear sales index (1947-49=100)	249.2	231.8	255.6
Foundry equipment new orders index (shipments, 1947-49=100)	97.9	159.9	154.2

* Seasonally adjusted

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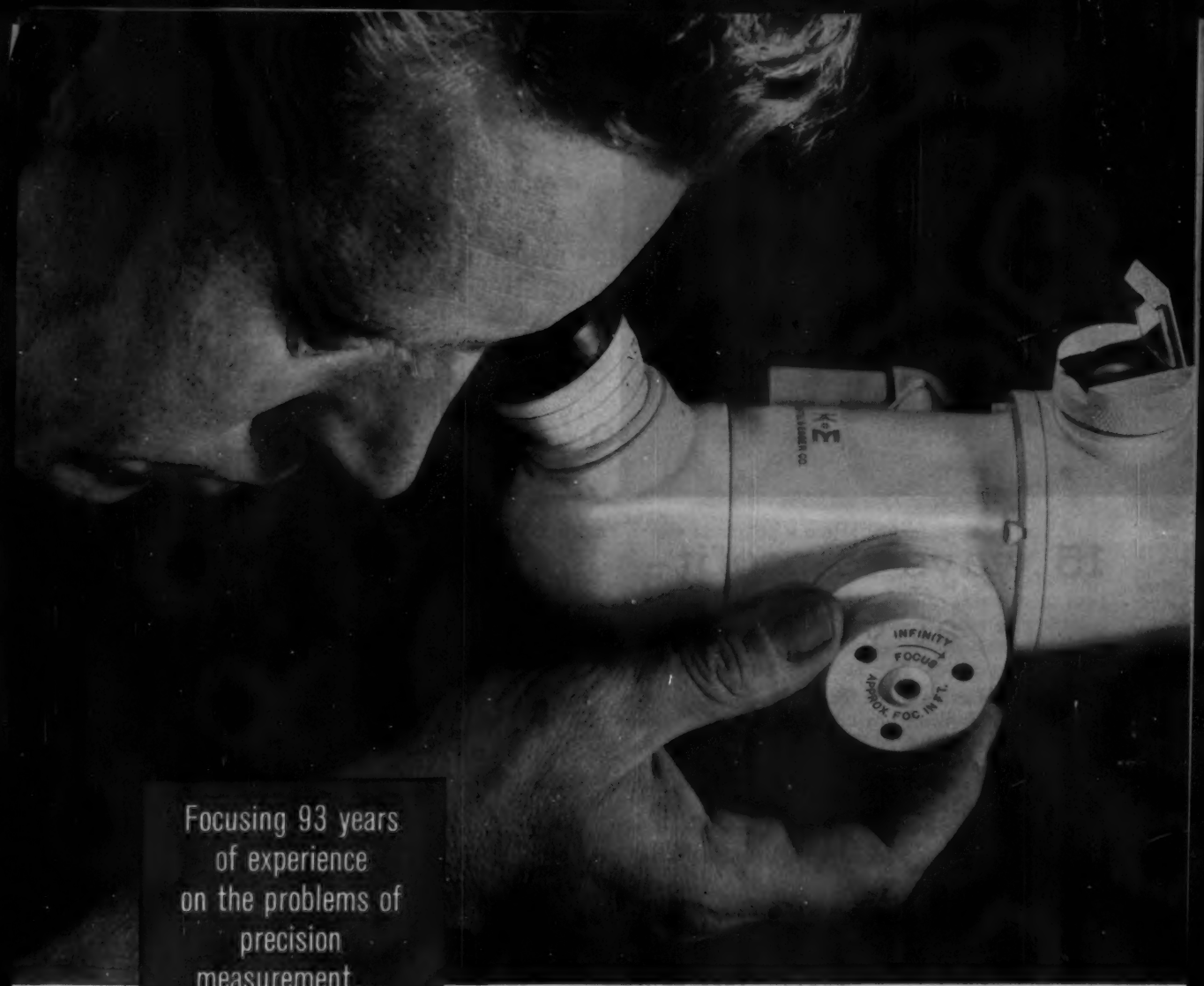

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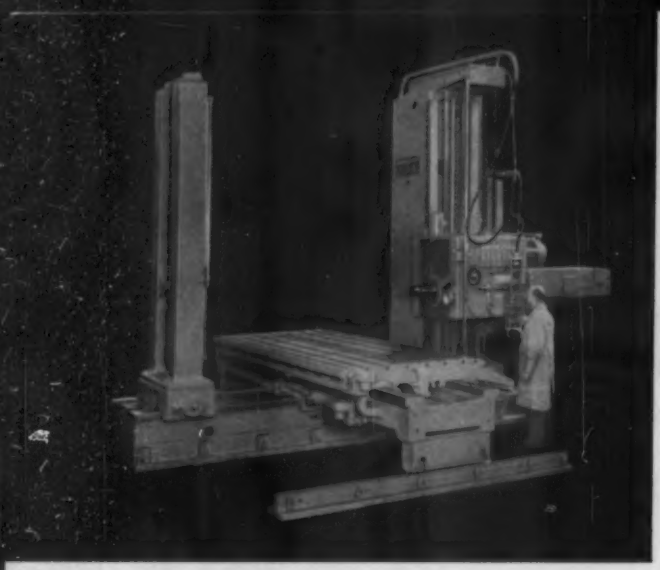

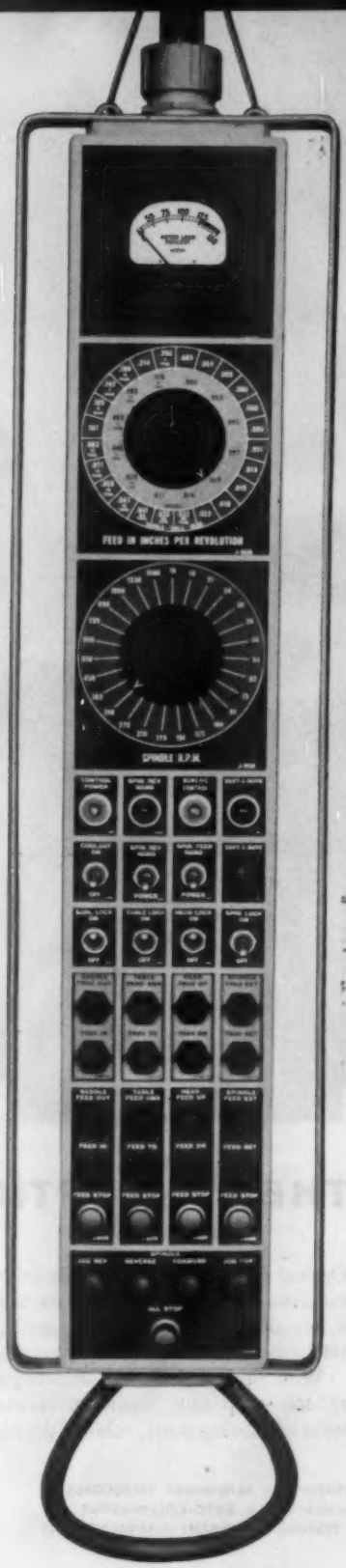

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1. Operator can see the cutter while controlling machine.
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American Machinist / Metalworking Manufacturing ESTABLISHED 1877

A Luxury We Cannot Afford

If you are looking for a success story, Western Europe is the place to find it these days.

It is astounding because it is so unexpected. Less than ten years ago even the most optimistic Frenchman or Englishman or German would not have predicted it.

Production curves have gone up . . .

through the roof. Far more vivid is the on-the-spot evidence of prosperity on all sides, day and night, to any visitor.

Retail stores have every imaginable item for sale and are doing a thriving business. Europeans have money and are spending it. Growth of automobile sales and usage is fantastic, thanks to installment buying and to a spectacular increase in the take-home pay of workers.

If you travel on week-ends, you get the impression that everyone is on the go by every available means, from hiking to Jaguars and Mercedes. Every restaurant and snack bar is full at all hours. And the posh dining establishments are overflowing with customers.

Building is proceeding furiously . . .

industrial plants, stores, office buildings, apartments, highways. Manufacturers are loaded with orders for everything, from heavy machinery to television sets, with automobile makers in the best position of all.

Much of the prosperity originates in a booming trade in world markets. More important is the rapidly rising standard of living at home. The British and Germans and French have never had it so good.

As the European metalworking industries profit from this unprecedented condition, they are obtaining a major advantage over us. They have built new, modern, well-equipped, low-cost factories. The average age of production equipment in European metalworking shops has been steadily declining. As the age goes down, manufacturing efficiency goes up. Management thus acquires precious cost advantages.

Our situation suffers badly by comparison with Europe's. Our physical plant and equipment are getting older and older. The average age today is higher than a year ago, or two years ago, or five years ago. And it will be still higher next year. Expansion and modernization are at a snail's pace.

If the current state of affairs . . .

should continue much longer, it foreshadows deep trouble ahead for our manufacturers in world and home markets. To make 1960 products with 1945 equipment is a luxury that we cannot afford. It is completely out of keeping with the sound policy of producing more goods for more people at lower prices.

There is good reason why it should not continue much longer. Production equipment builders have been busy developing brand-new machines that produce cost-savings and a quality of product heretofore unattainable. These machines will be on display in one place September 6-16—The Machine Tool Exposition at the Amphitheatre in Chicago.

A visit to Chicago in September should be a "must" for every alert metalworking manufacturing man. Only if the machines there are bought and put to work will you as a company and we as a nation be able to meet successfully the strong challenge of Europe's up and coming economy.

Burnham Finney EDITOR

NEW EVIDENCE

. . . . . marks superiority of standard V40 segments

Recent tests conducted on forged die steels proved standard V40 segments by Carborundum to be freer cutting and less costly to use than the nearest competitive type.

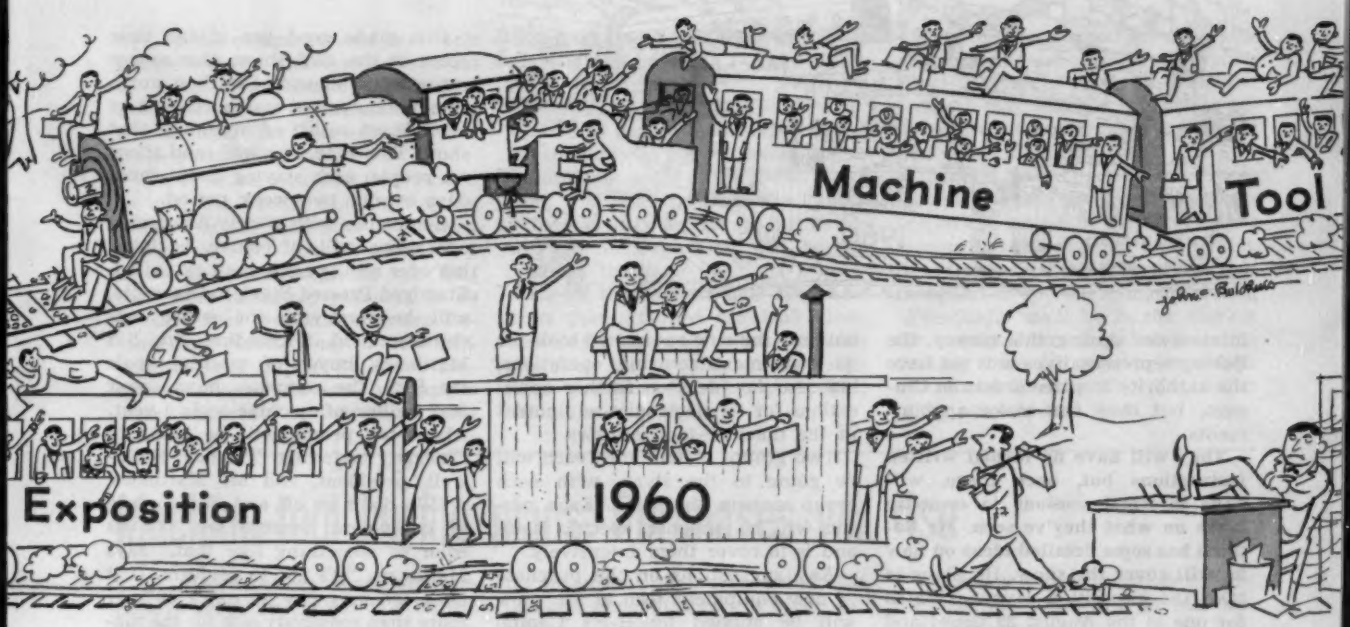
Details of these segment tests have been sent to all Carborundum salesmen and distributors for the benefit of other segment users.

Grinding B block die sets of uneven heights and with deep pits and heavy scale, the V40 segments outperformed competition by 35% based on overall operating costs. The V40 segments drew less power and ground cooler.

The rate of cut was 38% faster. Abrasive wear was 58% less. The V40 segments used in these tests were National Standards, available as 'shelf stock', by Carborundum.

Ask your Carborundum distributor about this *new evidence* on his next call.

This is a paid advertisement by The Carborundum Company, Niagara Falls, N. Y.



Who's going to Chicago?

"I'll be there if I have to walk."
"Miss a show like this one and you're five years behind the times."
"Personally, we think it's a waste of time."
"What show?"

Obviously, the Machine Tool Exposition is viewed in many different lights. The comments just quoted are only a few of those we got in a nationwide survey of metalworking companies' plans for attending the show. Looking over the results of the many interviews, we can pick out several general patterns. **It appears that the large companies will be going to the show with definite ideas on what to look for, and with the intention of really getting something out of it. Medium-size concerns, if they are within reasonable distance of Chicago, are planning to attend. But the smaller companies, in deference to their budgets, are passing it up.**

The biggest delegations will probably come from the auto industry. The manufacturing divisions of Ford Motor Co expect to send well over 1000 people to the show. Another auto company plans to send at least 1500.

As usual, there are many exceptions to the overall picture. One small company in Seattle told us that it is sending a man for several days, with instructions to study the numerical control equipment in particular. (This hardy representative, by the way, is also working a Kiwanis convention into his itinerary.)

On the other hand, we have the large company that considers the show a waste of time. No other company of any size shared this opinion.

How do the companies feel about the show? How do they plan to cover it?

Let's look at some individual replies and see. SKF Industries, in Philadelphia, plans to send about twenty men to the show. This is about the same number that went to the 1955 show, and that group reported they gained by attending and saw everything worth seeing.

For the 1960 show, each man will stay one or two days, and will be a member of one of four specific groups: (1) manufacturing development, (2) tool design, (3) production machinery, and (4) quality control. These groups will have no particular plan of attack for covering the show, but the specialists will be concentrating on their own fields.

Of greatest interest to SKF, and probably any other bearing manufacturer attending the show, will be equipment for production machining, grinding, and finishing of tubes and circular parts. Toolroom and maintenance machine tools will also be surveyed.

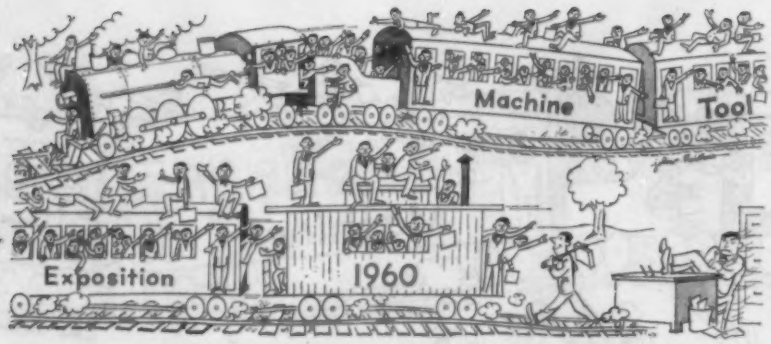
Two men in SKF's team will have the authority to buy on the spot, but it isn't likely they will do so. All those in attendance will, however, be authorized to make appointments for builder representatives to call.

Some 10 to 15 pieces of equipment are scheduled to be looked at because of pre-show publicity, according to C L Snodgrass at SKF. He also mentioned that the Coliseum Machinery Show and the Production Engineering Show may be covered if time permits.

This will give you an idea of the time some companies put into planning their show coverage. Another good example is Boeing Airplane Co in Seattle.

Charles Rapuzzi, equipment requirements engineer at Boeing, attended the 1955 show and says that the company will send 15 to 20 men to Chicago in September, at least five of them from manufacturing departments. They will be staying two weeks and will be hunting for ways to reduce overhead cost as well as direct costs.

As was the case with most people



interviewed during this survey, the Boeing representatives will not have the authority to place orders in Chicago, but they can make appointments.

They will have no formal written instructions but, once there, will have informal sessions to compare notes on what they've seen. Mr Rapuzzi has some detailed ideas on how he will cover the show. He plans to take the exposition layout [Watch for one in the August 22 issue] and divide it into geographical sectors, allowing one day for each sector and several days at the end for rechecking the items which seemed most interesting and promising.

He will also carry a portable tape recorder, into which he will comment upon various items that catch his eye. Upon returning to his office, he will have his secretary take his comments from the recorder and type them up for his review the second day after he gets back. Mr Rapuzzi points out that he has found written notes hard to decipher later, especially when you have to first work your way through all the things that have accumulated on your desk during your absence.

All Boeing's representatives will rank as superintendents or better, and each will have his own field of interest and will concentrate on that field at the show. Current plans also call for covering the Production Engineering Show at Navy Pier and the Coliseum Machinery Show.

Mr Rapuzzi's detailed planning probably comes as a result of some lessons learned at the 1955 show. Though he feels that he picked up some good cost-cutting ideas, he would have liked to have seen more of the show than he did. He tried to combine the show with other visits, and now admits that this was quite tiring.

Detailed planning by Hewlett-Packard, Palo Alto, California, electronics manufacturer, could pay off in two ways. Harold Rocklitz, head of the tool engineering department, points out that H-P will be looking not only for new automated tools for its own manufacturing operations, but also for ideas on further applications for its electronics equipment in the machine-tool industry.

Two groups of four men each will be going to the show, with each group staying one week. Each person will be assigned specific items and is to cover them intensively.

Any suggestions on the purchase of new equipment seen at the show will be studied by H-P's Capital Equipment Procurement Committee. (Some members of this committee will be in the groups going to Chicago.) **Items of general interest will be presented to plant managers, and machine-shop and tooling engineers through lectures when the representatives get back from the show.**

Right now, Hewlett-Packard is studying advance publicity and reports to get ideas on what to look for when they get there, and to see exactly who will be there. If time permits, it will take in the other two shows, but the Machine Tool Exposition is of primary interest.

What are they looking for?

More than any other thing, nunumerical control will be the focal point for most of the people taking in the show. From tube benders to milling machines, from punchpresses to you-name-it—if it's numerically controlled it will be sure to attract attention and prospective buyers. Over two-thirds of the companies answering our survey mentioned numerically controlled machines as prime targets for close study.

People seem to realize now that numerical control can be used profitably in almost any size shop. They no longer look at it as an "interesting demonstration." Typical is a reply from Otis Elevator Co, Yonkers, NY. "We know that tape control is here to stay, but what we know about it hasn't sold us yet, so we'll be looking over all the tape-controlled equipment at the show," said a company spokesman.

Otis made good use of the time spent at the 1955 show. Our source reports that about $3.5-million worth of new equipment was purchased as an indirect result of attending that show. This year, Otis will send about six people, each staying about three days over a two week period.

Companies with widely diversified operations will, of course, be looking over all the equipment exhibited. Standard Pressed Steel, for example, will be surveying the entire machinery field. According to Sid Matthews, buyer of machine tools for SPS, the company buys about $6-7 million of machine tools a year. About ten people will be going to Chicago, including Thomas Hallowell, president, and Mr Matthews.

"We don't go off and buy a piece of equipment because we like its color or something like that," says Matthews. "It's got to perform. If it does, we may pay an extra 50% or more than somebody else for the machine we want. Also, we want a machine that's backed by a reputable maker giving dependable service."

Each of the SPS men at the show will be given specific instructions and each will concentrate on his own field. SPS plans to cover the Production Engineering Show and, if time allows, the Coliseum Show.

Sperry Rand, another diversified manufacturer, will be sending 30 to 40 men to the show, about two for each of its divisions. Each man will spend 1½ to 2 days looking at all the tape control on display and at anything else that will help cut costs.

Special meetings are being arranged so that those who went to the show can tell others in their division what they saw of value. The Sperry Rand spokesman pointed out that the big builders have been putting out machines that are fine for the automotive industry, but now, with numerical control, they have something that will interest even the smallest job shop.

Advance planning

In our survey we asked companies if they were doing any advance planning for the show. **Of the companies that replied to this question, 60% said that they were making use of pre-show reports, articles, and direct-mail publicity to plan their show coverage. One or two good examples were mentioned earlier in this story.**

Will their representatives be given specific instructions on what to look for at the show? Or will the delegations be uninstructed? **Just about**

50% of the companies said that their people would be advised beforehand to watch for certain items. And about two-thirds of these companies are looking for numerically controlled machine tools.

When asked whether they intend to visit the Production Engineering Show and the Coliseum Machinery Show while in Chicago, **about 70% of the companies replying said that they were definitely planning to go to Navy Pier for the Production Engineering Show. Just under 80% plan to take in the Coliseum Machinery Show. Several companies were uncertain about these two shows, and said that they will cover them if time permits.**

Sidelights

- Several people made reference to the difficulty in getting something to eat or drink while at the show. We've been told that facilities for dining will be greatly improved; but as for a drink, improvisation will be the order of the day.
- Of all the medium and large size firms that attended the 1955 show, we've only heard of two that are not attending the 1960 show. One says it's a question of the travel budget; the other, time.
- One company, when asked whether they make use of pre-show reports for their advance planning, said, "No, I doubt that we'll let magazine reports affect our planning. But we do find them helpful."
- General Electric's Missile & Space Vehicle Department didn't send anyone to the last show for the obvious reason that the division didn't exist. But three men will be there this time, and as one GE spokesman said, "Eventually we'll be in the market for nearly every type of tool, including some not now in existence.
- And the Machine Tool Exposition is the place to find them.

Machine-tool buying plans: Purchases will rise

U S metalworking manufacturers plan to place orders for $1.5 billion of metal-cutting and metal-forming machine tools in the 19 months from June 1, 1960 to Dec 31, 1961.

An average of $79 million a month thus will be invested in new machine tools from now until the end of next year. Of that total, $65 million will go for metal-cutting machines and $14 million for metal-forming machines.

These stimulating predictions have emerged from a survey just completed by the editors of AMERICAN MACHINIST/METALWORKING MANUFACTURING. They represent a hefty increase over the buying volume that has prevailed the past year or two.

More than 1100 metalworking plants, of all sizes and from all metalworking industries, responded to this AM/MM Production Equipment Survey, which requested planned expenditures between June 1960 and the end of 1961. The table below breaks the total expenditure figures down into five metalworking-industry groups. It should be noted that planned expenditures are given for a 19-month period.

The Chicago Exposition Issue, Aug 22, of AMERICAN MACHINIST/METALWORKING MANUFACTURING will give full details on the survey, including a finer breakdown of spending plans —in 14 industries and 16 areas—and extended discussion of other questions asked in the survey.

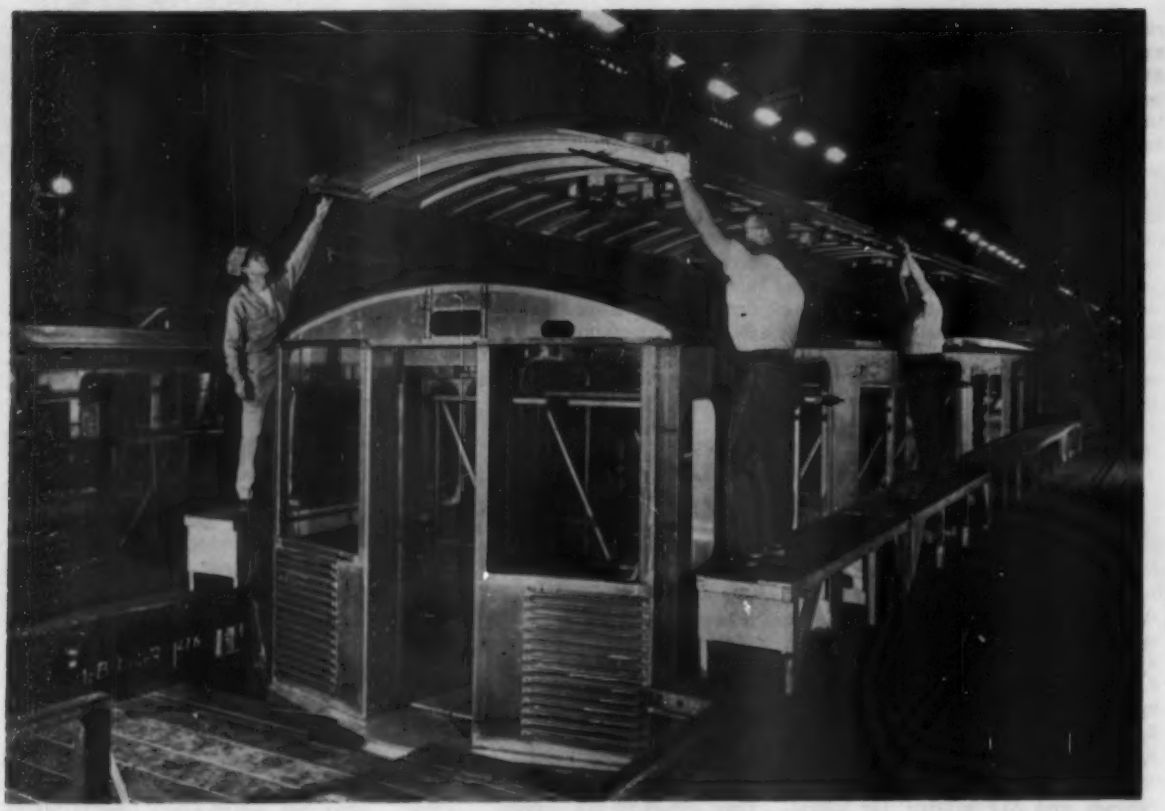
Other highlights of the survey:

- Over three-fifths of machine-tool purchases will be made by companies with fewer than 500 employees. In larger companies, the survey shows, spending plans are down, compared to other years. Spending in the automotive industry, in particular, is way down.
- The Metalworking - Machinery industry, often accused of being laggard in modernization programs, is going all out on new-equipment purchases. Indications are that a substantial percentage of this industry's investment will be in numerically controlled machines.
- Almost 16% of the money spent for machine tools will go into automated equipment.
- Average expenditure per plant, the survey shows, will be $71,100 for machine tools, both cutting and forming types. Per employee, this figure is $223.
- Purchases of foreign machine tools will be surprisingly low. More than one out of every twenty plants intends to invest in one or more foreign machine tools. But less than 3% of total machine-tool expenditures will be put into this area.
- Some 53% of the plants responding to the survey indicated that they now have manufacturing research programs. Average expenditure this year will be $33,000 per plant. In 1961, this figure will rise to $38,000.
- Outlook for modernization is bright. 44% of planned machine tools will replace existing machines.
- To supply tooling, 49% of all plants will call on their own tool shops. Some 36% will use services of the machine builder.

MACHINE-TOOL PURCHASE PLANS: JUNE 1960 THROUGH DECEMBER 1961

SIC*	Industry	Planned Expenditures (June 1960 through December 1961) Metal-Cutting Machine Tools	Metal-Forming Machine Tools	Total Machine Tools
34	Fabricated Metal Products	$212,000,000	$84,000,000	$296,000,000
35	Machinery, Except Electrical	407,400,000	59,900,000	467,300,000
36	Electrical Machinery, Equipment, and Supplies	154,500,000	48,900,000	203,400,000
37, 19	Transportation Equipment, Ordnance	301,100,000	55,400,000	356,500,000
38	Precision Mechanisms	31,400,000	4,800,000	36,200,000
	Other Metalworking Industries	127,000,000	18,900,000	145,900,000
Totals	All of Metalworking	$1,233,400,000	$271,900,000	$1,505,300,000

*SIC—Standard Industrial Classification



Stainless invades the subways

For the first time, stainless steel has been specified as the basic structural material for a large fleet of rapid-transit cars. By next January, Philadelphia's Market-Frankford Line will have 270 of them. First units have already been delivered, and, by September, The Budd Co will be turning out 2 cars a day from the assembly lines at its Red Lion Plant in Philadelphia.

Ever since 1932 Budd has been a strong booster of lightweight stainless steel construction for railway cars. These new rapid-transit vehicles, the company says, are lighter in weight and less costly to operate and maintain than any car of their size ever built.

The cars are lighter because stainless is stronger than carbon steel, and thinner gages will do the same job. In terms of the new cars, this means that the total weight is 52,000 lb, which is about 6000 lb—about 12%—lighter than a conventional-steel car based on the same specfications.

Less weight, of course, means less operating cost, especially less electric power consumption. The City of Philadelphia estimates that, during the 35-year depreciated life of the cars, it will net a total saving of $2,430,000 in the electric bill.

Lower maintenance costs will save even more. The stainless steel won't rust, and it can be used in its natural state, so it will never need to be painted. The City estimates this economy at $428 per car per year—a total of $4,044,600.

These figures are important in themselves, because they put a dollar value on factors that are usually treated as intangibles. However, they gain added significance from the fact that the Philadelphia specifications actually allowed a differential of $7000 per car in favor of stainless steel.

Philadelphia was the first to take this step. Toronto, however, has already made the same kind of allowance in a request for bids on 40 to 50 new cars, and others may follow.

Structural materials

In the cars now being built for Philadelphia, practically all the primary structural members in the car framing are stainless steel (AISI types 201 and 202). The only exception is the end underframes which are welded of low-alloy, high-tensile NES 65 steel in gages of ¼ and 3/16 in. and then stress relieved.

The stainless steel members range in thickness from 0.016 in. for the roof corrugations to ⅝ in. for the reinforcing gussets at the doors. Those guessets, however, are a sepcial case; the next thickest stainless parts are the side sills at 0.210.

For strength, the cars depend very much, of course, on the stronger material and on the corrugations that beef it up. Actual squeeze tests have exerted a static end load of over 200,000 lb on the cars, and the total crippling strength of the floor is over 275,000 lb.

According to Budd, the car structure is designed as a girder, using the roof and the floor as the chord members connected by the sides, which join the entire car cross section into a load-carrying beam. In a sense, the design is similar to the new "unitized" automobile bodies that combine frame and shell into a single, integral unit with each part giving strength to the whole.

Bandsaw monitors its own feed forces

How fast can you feed a bandsaw without damaging either the feed or the work? This has long been a matter of operator skill and judgment. But now, DoAll Co has come up with an attachment that takes the guesswork and risk out of sawing.

It is a simple transducer attached to the toolpost. As the work is fed in, it presses against the saw band, which in turn deflects the toolpost changing the transducer's electric value as the feed rate is increased or decreased.

The information is transmitted to a dial on a console. Looking at it, the operator can then adjust the feed rate to meet cross section changes, and can use the highest possible cutting speed without endangering the work or the blade.

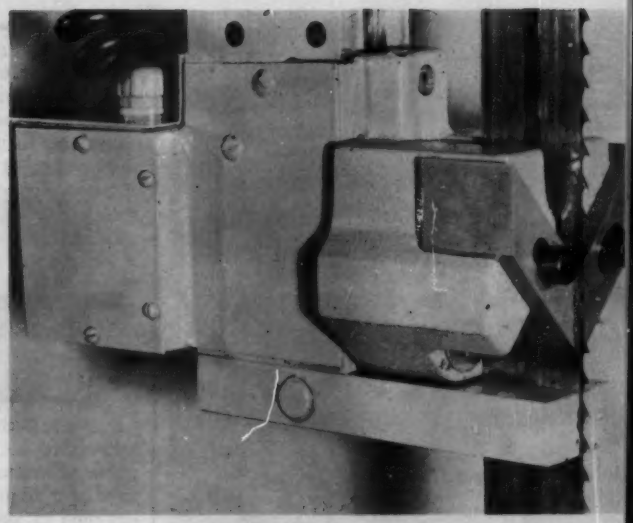
Called the Feed Force Meter, this device is standard equipment on DoAll's biggest (2-inch-wide band) table bandsaw, the Band Mill.

Automatically prevents overfeed

It is also available in automatic form. Then, the indicator is replaced by a relay meter—when the feed force becomes too great, an impulse stops the feed motor, then restarts it when the force drops below the danger point.

A holding circuit is included in this automatic system, to prevent on-off operation when cutting easily machined material. The circuit's preset delays stop the feed drive at each adjustment interval long enough to prevent oscillation buildup.

The Feed Force system is based on the principle that feed force decreases as saw speed increases—up to a certain point. Beyond that, the force begins to rise again. For maximum cutting accuracy and least tool wear, it is necessary to operate at this optimum speed.

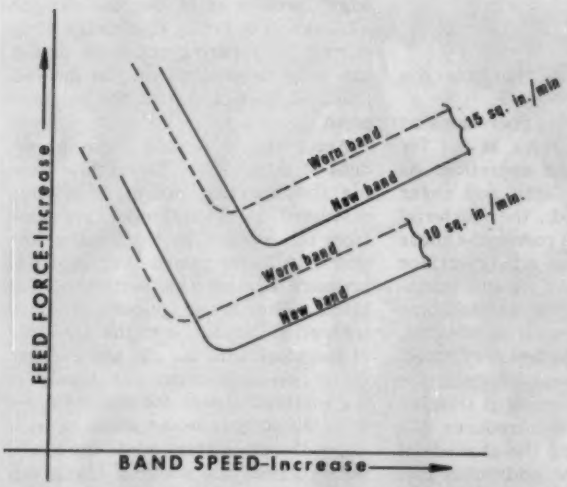


As work presses against the saw blade, the blade presses against a transducer on the toolpost, causing it to vary in reluctance. Electric output then reads as feed force on a dial

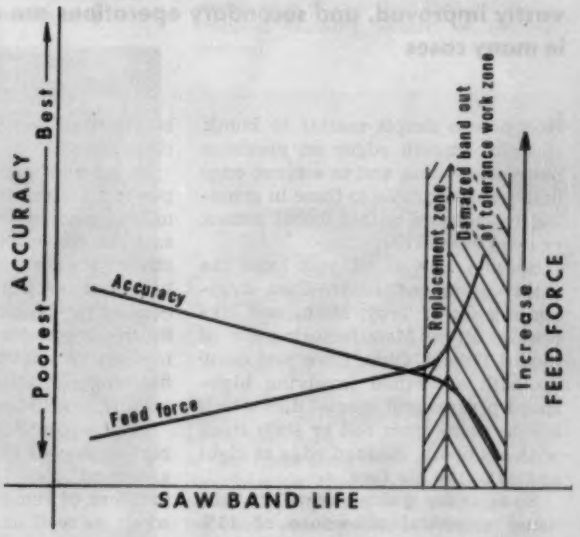
Constant check on blade condition

Too, as a saw blade dulls it loses its ability to cut accurately, and the force required to feed the blade into the work increases. Unless the blade is replaced in time, its inaccuracy will go beyond the tolerable limit.

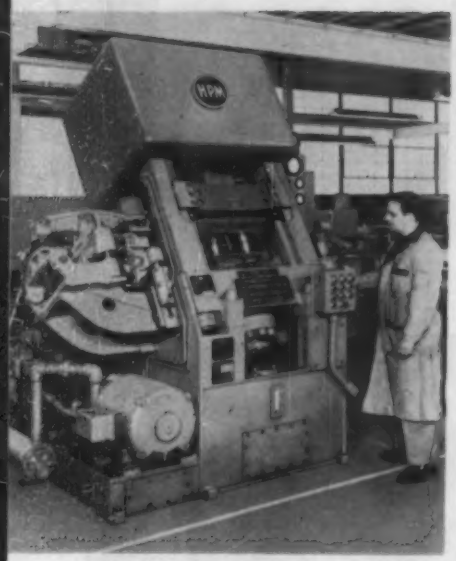
With the Feed Force system, the operator can thus not only determine the optimum acceptable feed, he can—with a little experience—know when a blade needs replacement.

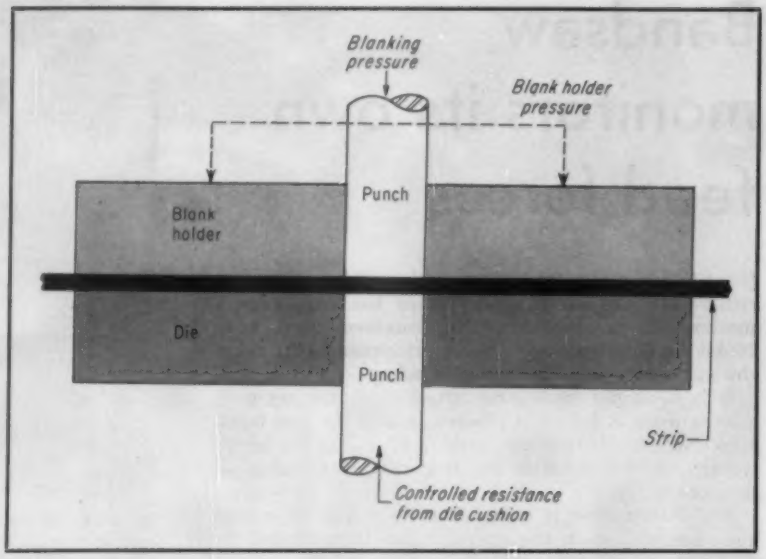


Up to a point, an increase in saw speed decreases the feed force. Beyond that point, increases in saw speed increase required feed force



Accuracy decreases and feed force increases as a saw wears. Feed Force Meter warns operator of decreasing accuracy, lets him know blade needs replacing





High-speed hydraulic press and special dies . . .

. . . insure smooth-edged blanks. Blanking press (left) runs at 120 spm, is the prototype for a new line designed for use with coil stock. Machine has an intermittent roll feed and scrap cutter, both synchronized with the press's action. Electrical controls are standard, make use of time delays to start the motor under load. Principle of die design (right): Metal flow is restricted by clamping the material from top and bottom. Result is a clean shearing action

"Smooth-edge" blanking made EASY

By George H DeGroat, Detroit Editor

Special dies teamed up with new triple-action, high-speed hydraulic presses now shear sheetmetal blanks completely through, leaving straight, smooth edges. Quality of product is vastly improved, and secondary operations are eliminated in many cases

It is now a simple matter to blank straight, smooth edges on precision parts every time, and to achieve edge finishes comparable to those in grinding (accuracies within 0.0005 inches, or even closer).

Simple, that is, if you have the right equipment. Hydro-Cam Engineering Co of Troy, Mich, and Hydraulic Press Manufacturing Co of Mount Gilead, Ohio, have just come up with a method involving high-speed presses and special dies which blanks parts from coil or strip stock with a smooth, sheared edge at right angles to the die face.

So accurate is this method that the usual empirical allowance of 10% of stock thickness for punch and die clearance is out. A wide variety of materials and stock thicknesses can be blanked without changing die clearances.

In ordinary blanking operations on power presses, the stock is cut for only a portion of the operation. As soon as the elastic limit and shear stress are exceeded, the material breaks or tears. As a result, the shear edge of the blank has a poor surface finish—unsuitable for smooth transmission of movement unless some finishing operation such as shaving, milling or grinding is first performed.

In the conventional method, the part is shaved by forcing it through a second die. This introduces the problem of removing the shaved-off scrap, as well as the additional cost of an extra set of tools and the cost of time consumed in performing the operation. Moreover, even with the most accurate tools, these secondary operations affect the accuracy of precision parts, especially in connection with dimensions from hole centers to outside contours.

Half the trick of the "smooth-edge" process is in the die design; a blankholder firmly clamps the strip during the shearing action so that it can only be sheared on the desired line and doesn't tear at the weakest point.

According to Arnold Pape, president of Hydro-Cam, metal flow during the blanking operation is thus restricted by blankholder pressure from the top and by the holding action of a lower punch that provides pressure against the bottom of the blank. The lower punch provides controlled resistance to the entrance of the stock into the die and recedes under pressure from the blank as the material enters the die. At ejection, the strip is raised about ¼ inch above the die surface while the lower punch raises the sheared blank out of the die. An air blast blows the blank from underneath the strip and out the back of the die set.

Main ram pressure, blankholder pressure, and the pressure applied by the lower punch are adjustable to suit various materials.

The other half of the process involves use of a triple-action, high-speed, 30-degree inclined hydraulic press. Circuitry in the new press provides for this sequence of actions: (1) die cushion pressure to clamp the strip from the bottom; (2) blankholder pressure from the top; and (3) main ram pressure for blanking. This force acts on the material lying on the lower punch and overcomes the constant pressure applied to this punch by the die cushion. As a result, the lower punch retracts while the blankholder pressure remains constant. The three actions of the press are controlled by mechanically synchronized valves.

Speed of the press is about twice that available in ordinary hydraulic presses (120 spm, adjustable to 40 spm). With a 1½-in. stroke length, ram closing speed reaches 1140 ipm with 1170 ipm return speed.

Three constant displacement pumps are used in this prototype—the first of a line of three sizes to be brought out by HPM. Later models will have two pumps, but this one was built to handle special loads such as shearing steel ¼ in. thick. (Most work of this type doesn't exceed ⅜ in.)

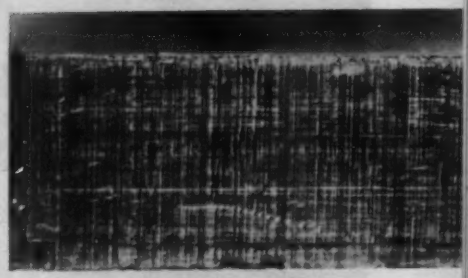
An 86-gpm pump at 400 psi pressure is used for rapid traverse or approach strokes under no load. The actual working stroke is handled by an 11 gpm pump at 3000 psi, and in the prototype the third pump is of the same capacity. With air controlled relief valves, pressures can be preset for any operation.

Two accumulators work in conjunction with the pumps and store pressure during the idle portion of the cycle. These devices reduce the need for larger pumps and provide high speeds and pressures during all the press motions. A 10-gallon, low pressure accumulator is connected to the 400 psi pump and a 2½-gallon capacity, high-pressure accumulator works with both 3000 psi pumps to absorb hydraulic shock that might be caused by quick valve action.

P J Lindner, chief engineer of Metalworking and Process Presses at HPM, points out that the process is definitely an application for hydraulic presses, which eliminates (1) the need for shimming dies in precise setups, thus reducing excessive setup time, and (2) the adjustments usually needed for die wear in conventional blanking operations with mechanical presses.

Once the required pressures have been established in the hydraulic press for blanking, for the blankholder, and for the die cushion, they remain constant. On the other hand, when blanking pressures change with variations in material thickness and from other causes during the cycle of a mechanical press, they cause serious problems.

A hydraulic press develops maximum pressure when the greatest resistance is met—so that accidental doubling up of parts under the ram is no problem. But where the maximum pressure developed by a mechanical press is set for a point near the end of the crank stroke, doubling up causes this pressure to occur at a higher point. The resulting excess load on the frame breaks it.

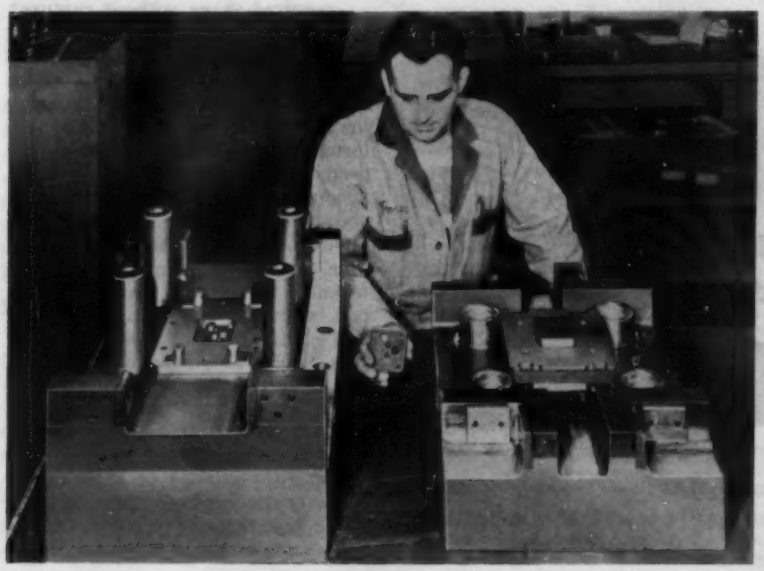


"Smooth-edge" stamped blank

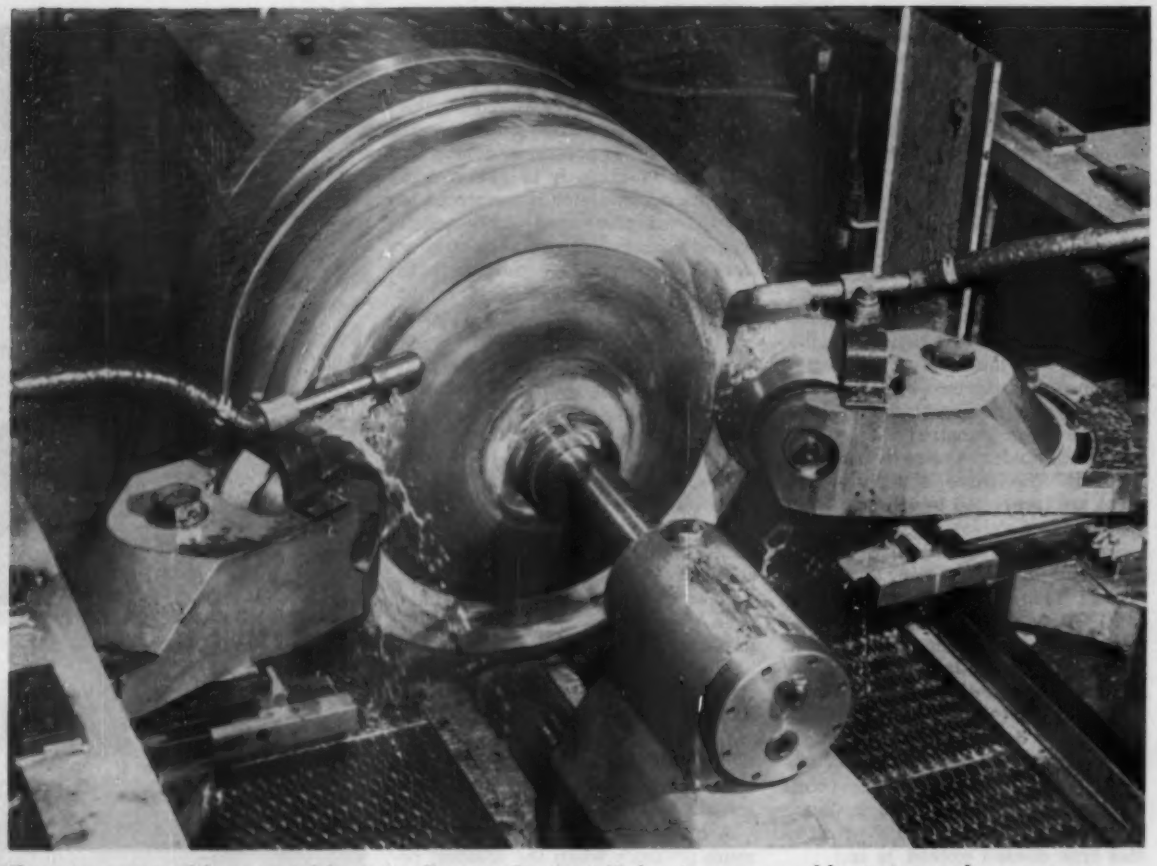
Conventional blanked edge

Shaved edge of stamped blank

Better edge finish is achieved with the smooth-edge process (top) than with conventional blanking (center) or shaving (bottom)



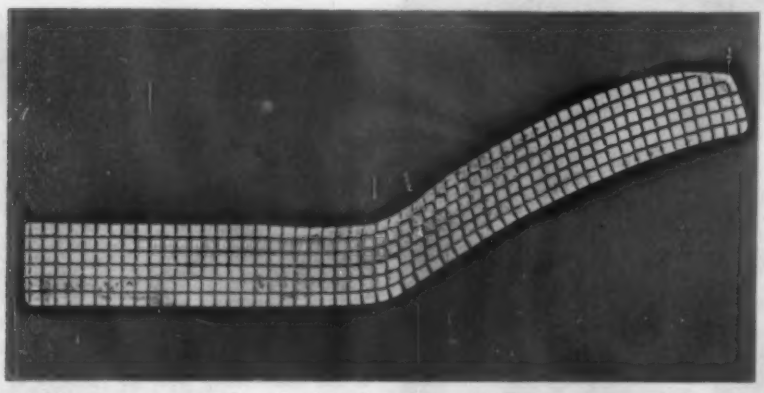
Special dies (left) teamed with hydraulic pressure allow blanking of various materials and stock of varying thicknesses in the same setup with no changes in die clearance. Fine finishes in holes and on outside edges are achieved by blanking and piercing AISI-C-1010 O-ring plates (right) in a compound die. Plates are 0.0478 in. thick, with surface flatness and smoothness specified within 0.001 in.



Three components of force exerted by each roller at a Cincinnati Hydrospin are measured by strain-gage dynamometers

How to improve your shear-forming technique

By Serope Kalpakcioglu and Richard L Kegg, senior research engineers, Physical Research Dept, The Cincinnati Milling Machine Co, Cincinnati, Ohio



Grid lines on a cross-section of a shear-formed sample illustrate how work flows internally as shear force is applied

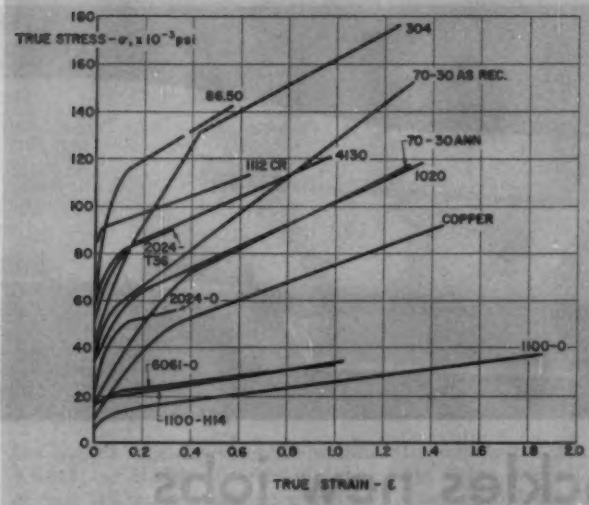
1. **Can the work material take enough stress to shear-form to required shape without rupture?**
2. **Does the machine have enough power to move the metal all the way to final contour?**

These are the most important questions you can ask about a shear-forming operation. Sometimes an experienced operator can make a good guess; but more often he has to try one blank and see what happens.

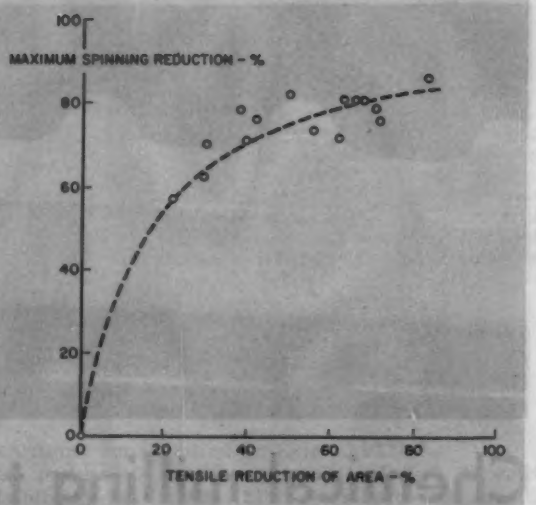
But cut-and-try will work any time, on any operation. The trick is to know beforehand what will happen, without wasting time, energy, and equipment on operations that may well be non-productive. It should be possible for laboratory research to produce some of the answers ahead of time, to make shear forming more a science than an art.

One of the basics in shear forming is the equation,

$t_e = t \; x \; sine \; a/2$, where t_e is the



Stress-strain diagrams for various metals show relative resistance to shear-forming; 304 stainless will take more power than 1020 steel



Shear-formability is most consistently indicated by test of tensile-reduction-in-area of work-material samples

thickness of the formed cone, t is the original thickness of the blank, and a is the included cone angle. This is the critical point where shear forming differs from conventional spinning, because the finished work thickness is less than the original thickness by a controlled amount, depending on the angle to which the work material is sheared.

Advantage of the process is that parts with rotational symmetry can be formed in relatively short time with practically no waste of material, and with mechanical properties improved by cold working.

There are really two groups of problems when you consider the variables involved in shear forming. Dependent variables include force, fracture, finish, and fit. Independent variables include properties of the material, blank thickness, mandrel angle (in shear forming) or percent reduction (in tube forming), feed, mandrel rpm, roller geometry and diameter, work temperature, lubricant, and coolant. All these factors must be established, then relationships between them recognized.

Shear forces

The tangential force is small in relation to the other forces acting on a shear-forming roller, but it is most important as far as power consumption in the process is concerned. From an analytical study of the mechanics of the process, it has been found that tangential force is a function of material thickness, feed, cone angle, and the tensile stress-strain curve of the work material. Note in the accompanying chart that materials differ greatly in their stress-strain curves. Similar analytical work has been done for the axial and radial forces involved at the roller.

The second most important factor in shear-forming power is fracture, which is the opposite of formability. It is most desirable to test a small specimen of the work to find out what amount of wall reduction is possible before fracture develops.

For this purpose, we designed an ellipsoid mandrel of about 8-in. maximum diameter, with increasing cone slope that would produce a part with gradually varying wall thickness. The nose area would have the thickness of the original flat blank, and the skirt would gradually fair down to zero thickness. Fracture would have to occur between these limits.

Sixteen different materials were formed on this test setup, made at a Cincinnati Hydrospin machine equipped with a pair of dynamometers capable of measuring forces in three principal directions up to 50,000 lb. In addition to recording instruments, the test setup included equipment for tensile, hardness, surface-finish, and metallurgical tests.

Each sample part was formed to the point of fracture, which was recorded as percent reduction in wall thickness. This maximum shearing reduction was compared to the mechanical properties of the material; hardness, yield and tensile strength, strain-hardening coefficient, % elongation is 2 in., tensile reduction of area at room temperature and at ordinary low strain rate.

It was found that the most consistent indicator of shear-formability was percent reduction in area, while other properties were found rather inconsistent. Thus, when a given material is considered for a certain shear-forming operation, its % reduction in area should be applied against the accompanying curve to find its relative formability.

Performance factors

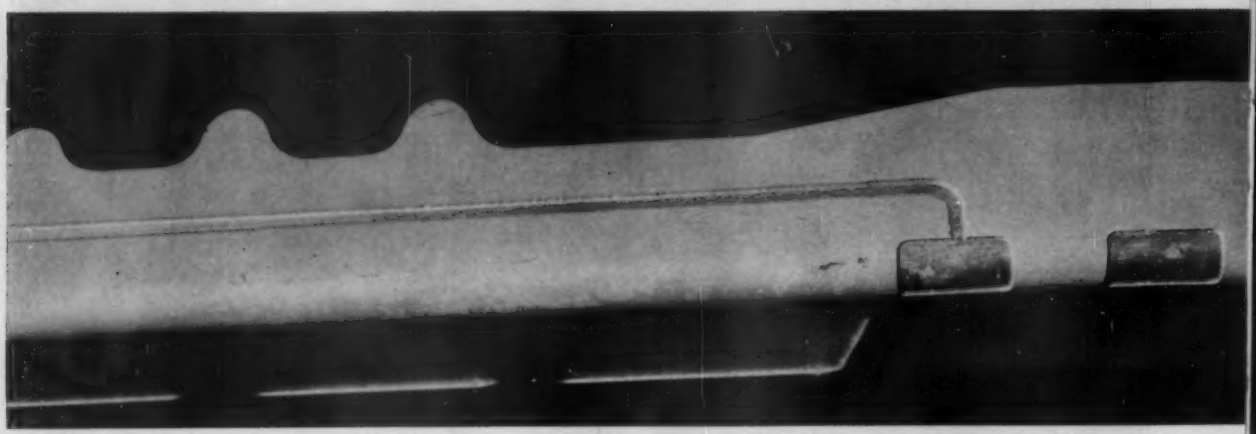
If a part is reduced in wall thickness more than indicated by the basic equation above, that part will withstand greater reduction before fracture than will a part that has been under-reduced.

Under-reducing produces a part that fits the mandrel loosely; while over-reduction produces a tight-fitting part. As the mandrel angle increases, the part must be further over-reduced to keep it fitting the mandrel tightly.

Surface finish was found to be a function of roller geometry and feed. Some roller designs other than simple true radii have produced finishes as fine as only a few micro-in.

For more information on shear forming . . .

Explorer Spotlights Roll Flowing—AM— *Mar 24 '58, p 106*
Computer Synthesis Can Simplify Roll-Flowing Setup—AM— *Jun 1 '59, p 116*
Shear-Forming Formula (Metalworking Report)—AM/MM— *May 30 '60, p 2*



Chemical milling tackles new jobs

By Joseph Kincaid, tooling and methods engineer,
and Richard Zants, equipment and process engineer,
Manufacturing Engineering, Grumman Aircraft Engineering Corp

Some really tough machining jobs—trimming scalloped edges, cutting recesses, cleaning foreign obstructions out of stainless steel tubing—are now being done at Grumman Aircraft with chemical milling, which of course isn't a machining process at all.

These new techniques lift applications of chemical milling from the merely difficult (reducing metal thickness, cutting pockets, tapering) to the almost-impossible—and at a considerable reduction in tooling lead time and tooling costs.

Take for instance trimming of scalloped edges for wing-beam units for the Gulfstream executive transport. The part: a formed channel 23 feet long, made of 0.125-inch aluminum. In addition to a scalloped edge, it had recessed pockets and a lengthwise sealant groove. Router tooling could not be fabricated soon enough to meet schedules for the initial wing-beam units. Chemical milling, on the other hand, required only simple scribing templets, which could be made relatively quickly.

During the chemical-milling operation, after the pockets in the upper side of the beam were step-etched, the scalloped shape was scribed from a templet into the mask on both sides of each flange. Then the mask was pulled off to expose the unwanted material.

As the sealant groove was to be etched at the same time, the mask was also stripped from this area. Then, while the sealant groove was being chemically milled to a depth of 0.057 in., the unwanted edge material was reduced by twice this much, leaving only 0.009 to 0.011 in. of the original 0.125-in. material.

After the chemical milling cycle, the excess material was broken from the part at the scalloped trim line. Then the edges were deburred and finished with a special cutter on a portable drill.

Cutting tool recesses

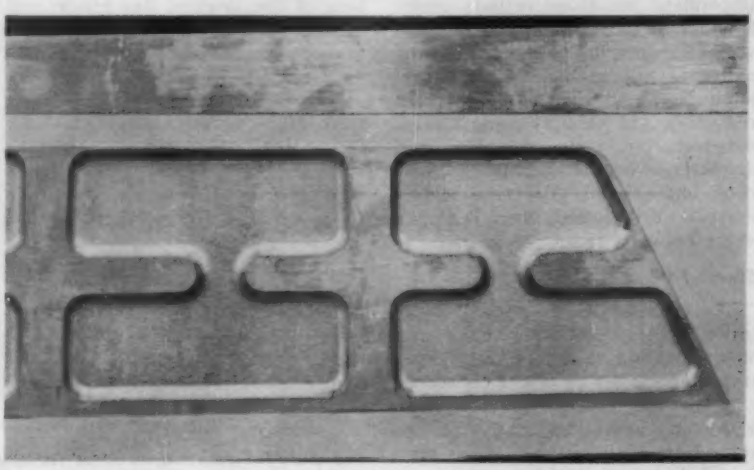
Here, chemical milling actually performed a simple diesinking operation on tools for adhesive bonding.

The complete tool consists of two plates. One of them had to have recesses 0.250 in. and 0.031 in. deep. The other was a flat plate.

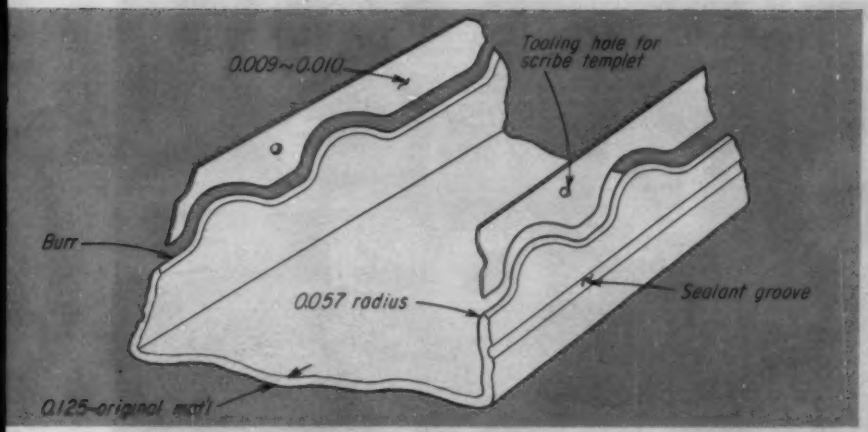
When the tool is employed for a bonding operation, formed "pan" details are placed in the recesses. Then the flat skin parts are laid over them and compressed against them by the flat member of the tool.

As the recessed plate was a "relief" type of tool, it did not require precision machining. Therefore, Grumman decided to remove the metal by chemical milling and evaluate the results.

The operation was performed by normal step-etching procedures, and



Recesses sunk by chemical milling in 7075-T6 stretcher level stock hold formed parts for bonding operation. Other side of tool, a flat plate, holds flat skin against the formed parts



In a single operation, chemical milling cuts scallop and groove in wing beam (left) and also reduces tooling lead time. Beam comes out of bath, etched as shown in sketched section. Unwanted material is broken off and remaining scalloped edge is finished with special cutter in portable drill

the depths of cut were held within ±0.010 in. Surface finishes did not exceed 175 mu in., and there was no warpage. As these characteristics are well within the requirements for such tools, the technique has become a standard operation.

Cleaning tubing obstructions

Chemical milling with caustic soda will etch aluminum but will not readily attack stainless steel. Because of this feature, Grumman was able to salvage a group of aluminum castings whose internal stainless steel fuel lines were partially obstructed with spattered aluminum.

The aluminum got there in the first place because the internal fuel lines had not been plugged before the pouring operation. It was easy enough to remedy the error on future runs, but there was still the problem of cleaning out the units already produced.

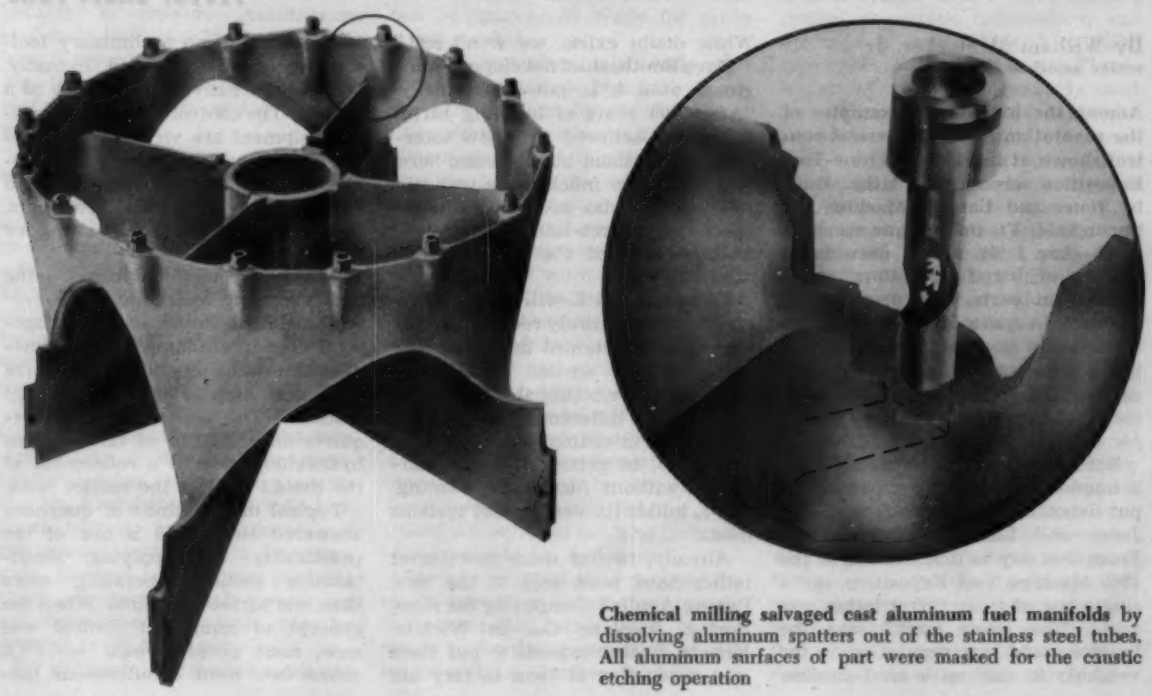
In general, the chemical milling procedure for this cleaning was to mask all the aluminum surfaces of the casting so that only the insides of the stainless steel tubes were exposed to the etchant. Then each part was immersed in the caustic etchant long enough to make sure that all the internal spatters of aluminum would be dissolved.

First, the entire part was cleaned in Oakite No. 164 for 25 min at 180 F and then rinsed thoroughly with a hot-water spray. Then, after all the stainless steel tubes were sealed off, the whole part was given three dip coats of Turcoform Mask No. 504 and cured for 75 min at 225 F.

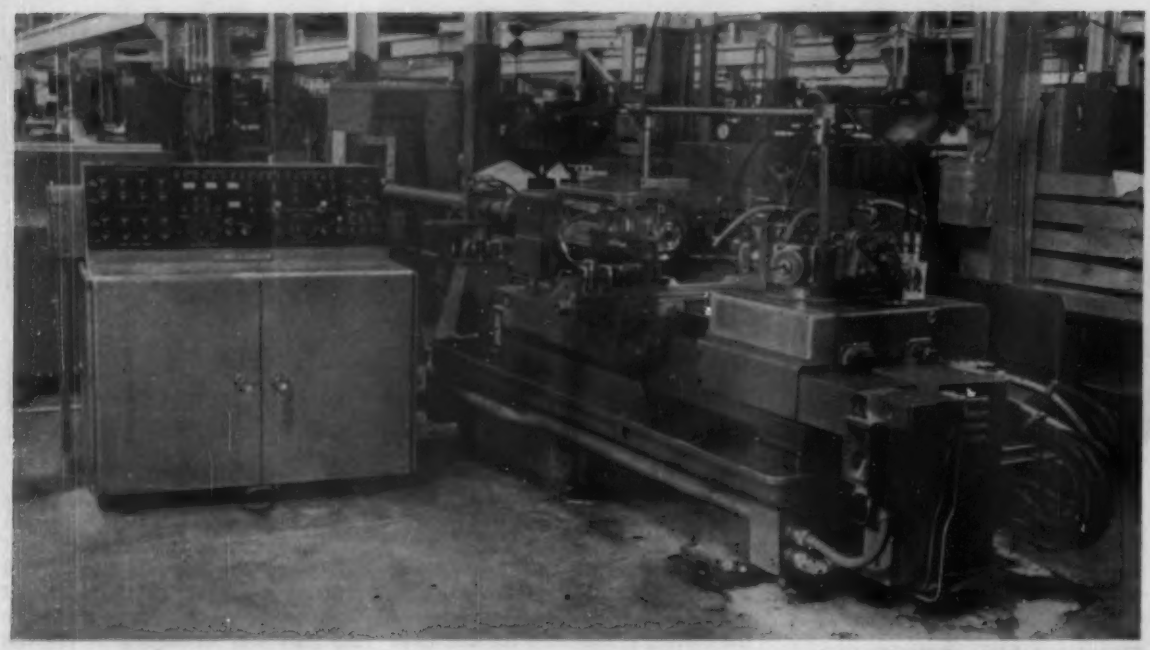
When the part cooled off, the ends of the tubes were uncovered and all edges were given two brush coats of unthinned No. 504 mask for added protection. These extra layers of mask air-cured for four hours before the part was immersed in the hot Chem-Mill Etchant (Caustic).

Unfortunately, there was no way to tell how thick the aluminum was inside the tubes. However, at an etch rate of 1.1 mils per min per surface, a four-hour bath made sure it would all be removed.

At the end of the etching time, the part was rinsed thoroughly with hot water and dipped in CP No. 70 stripper for six minutes. This was followed by a water rinse and hand removal of the mask.



Chemical milling salvaged cast aluminum fuel manifolds by dissolving aluminum spatters out of the stainless steel tubes. All aluminum surfaces of part were masked for the caustic etching operation



Convertible turret lathe, numercially controlled, can be set up as either a bar machine or a chucker in 10 to 15 min. Designed for short runs (1 to 50 pieces), the machine positions within ± 0.001 in., repeats to ± 0.0005 in. Drive motor is 30 hp on this 2½ in.-dia by 24-in. machine. Spindle speeds are 40 to 2000 rpm in 24 steps. Feed rates for carriage and saddle are 0.750 to 30.0 ipm, in 16 steps, plus fast motion. Cross-slide operates at one-half these rates. Tape input information can be adjusted by dials on the control panel. Price is $87,000 with main drive motor and two square turrets.

Now it can be sold:

Tape plus tooling make turret lathe practical

...for short runs

By William M Stocker, Jr
senior associate editor

Among the half dozen examples of the revolution called numerical control shown at the 1955 Machine-Tool Exposition was a turret lathe. Built by Jones and Lamson Machine Co, Springfield, Vt, this unique machine (AM—Aug 1 '55, p 106) drew large crowds of awed spectators as it turned out parts with precise regularity. No operator guided the motions of that machine; it was watched by an observer who did nothing but occasionally feed it another piece of metal to chew. *The machine wasn't for sale.*

Before that two-week show ended, a number of people were ready to put deposits on the barrel-head. But Jones and Lamson wouldn't sell. From that day to this, the eve of the 1960 Machine Tool Exposition, not a single one of those turret lathes was sold. "Too many bugs," says the builder, "and our reputation is too valuable to risk on a semi-success. While doubt exists, we won't sell."

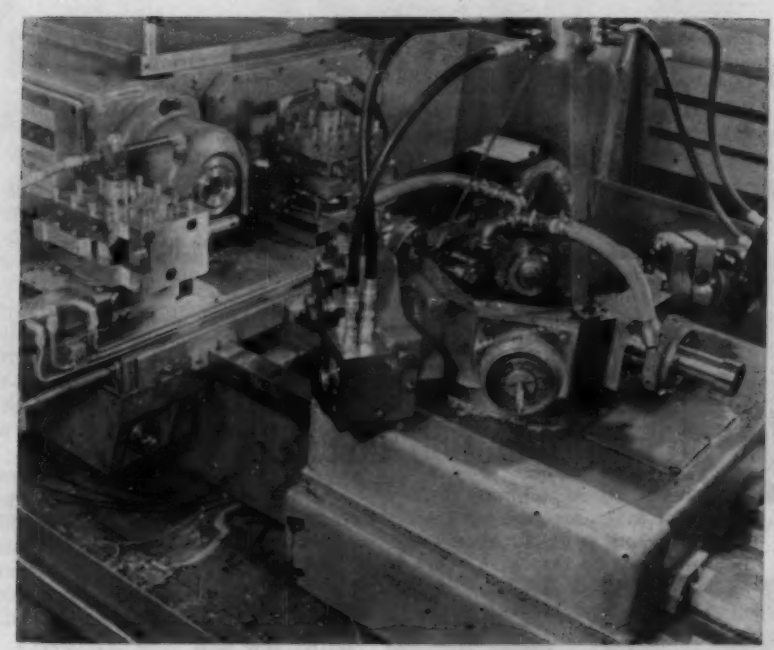
Dave Smith, chief development engineer at J & L, put it succinctly. "After 100 years of building turret lathes, we believed we knew something about them but Herman, here, taught us how much there was still to learn. He also gave us added respect for turret-lathe operators." They nicknamed the original lathe "Herman."

This year J & L will show a new turret lathe. Entirely redesigned, engineers have retained the sound features of the earlier model and replaced the questionable elements. Most of the differences are in programming, in coding, and in control capability; in getting to each "end-point" without fussing or hunting. J & L builds its own control systems now.

Already, two of these new turret lathes have been sold to the new Boeing Applied Computing Services, Boeing Airplane Co, in Wichita, Kansas. Boeing expects to put them into production as soon as they are installed—with no preliminary toolroom or check-out period. Actually, this customer isn't taking much of a gamble. The control system and power equipment are virtually identical with those used in the many numerical positioning devices supplied by J & L during the last few years. Boeing's BACS has tapes waiting for this machine.

Essentially, the new turret lathe uses the same hydraulic servo system installed in the J & L tape-controlled positioning table. However, for lathe operation the force level is as high as 8000 lb on turret motions. The positioning table requires only 1500 lb of thrust. This hydraulic system is a refinement of the design used in the earlier lathe.

Typical of the kinds of questions answered since 1955 is one of the practicality of supplying simultaneous motions—operating more than one turret at a time. When the concept of numerical control was new, most people would say, "Of course we want simultaneous mo-



Preset tooling, plus taped information, is key to maximum machine utilization. All tools and toolholders are designed for adjustment and setting in the toolroom. Hexagonal turret on saddle is fitted with "Hydraulic" chucking adapters for adjustable tool holders. Two square turrets on cross-slide have precision ground recesses to accept toolholders for 1¼ in.-high commercial cutting tools

tions. Look at the time we'll save."

J & L engineers analyzed 100 random jobs. Of this number, only 5 pieces permitted advantageous use of simultaneous motions—and the saving in cycle time for them was 5 to 10%. Thus the saving averaged ¼ of 1% for 100 different pieces. Capability to provide simultaneous motion is built into the control system, if the customer needs it. Limiting the control operation to one motion at a time takes $5000 out of the control cost.

Similarly, infinitely adjustable feeds and speeds can be provided but aren't standard on the turret lathe. It always is necessary to reach an "end point"—the next instruction—to change speed or feed rate. Infinitely adjustable feed-speed capability would make the machine "continuous path" and would create more circuit complexity than appears necessary or worthwhile.

In keeping with the present concept of numerical control, the new turret lathe is designed for short-run production. It has the capacity of a No. 5 machine (2½ in. x 24 in.). Three turrets, one hexagonal and two square, accept up to 14 preset tools. Located on reference surfaces which are part of each turret, the full complement of tools can be changed in 10 to 15 min.

To eliminate all machine adjustments—and the need to make a "first piece" by trial and error—as well as to keep all tool preparation off the machine, each toolholder has adjustable locating surfaces. All presetting is done in the toolroom or crib with dial gages, setting gages or a comparator. A set of tools plus the tape can be "packaged" ready for setup when needed.

Some first-piece trial and error cannot be avoided—especially when the part is made for the first time. The programmer can specify required dimensions but it is practically impossible for him to anticipate and compensate for unknown characteristics. Correcting for errors in shoulder length, diameters, hole depth, etc, because of work deflection, tool spring, turret spring, temperature expansion and similar operating conditions, can be done at the machine.

To simplify and speed adjustment, 22 dials are provided on the panel of the control console. Each dial, or motion, has a range of adjustment of ± 0.015 in. This compensating measurement is applied to the original measurement dictated by the tape. Dialed adjustments can also be made to compensate for tool wear.

Savings in setup time provide the major benefit in using the numerically controlled turret lathe. In addition to the direct reduction of idle machine time, further benefits are found in producing smaller job lots at more frequent cycles to better balance following operations. And, making parts as they are needed can save substantial sums in semi-finished parts inventories.

For replacement and spare parts, numerical control permits breaking into a production cycle, even for one piece. It takes only 5 to 10 min. to change tools and tape. Then, when the needed part is finished, another 5 to 10 min. has the lathe back on the production cycle again.

Not to be sneezed at is another benefit that J & L calls "secondary." Productivity, on the numerically controlled turret lathe, is increased 25 to 30% over standard cycle time. Even the automatic bar feed is programmed from the tape.

Short-run orders are thought of as from one to 50 pieces. Most economical use recommended is to tool the turret lathes as a bar machine, for example, and do all of the stepshaft work. Then set the lathe up as a chucking machine and do all of the gear blanks. The only changeover required from job-to-job is in barfeed collet pads, three-jaw-chuck jaws, etc, to adapt the machine for change in shape. All of the part dimensions are on the tape.

Standard tape and code

Operating information is coded on one-inch-wide, eight-channel perforated tape according to a program. The Jones and Lamson numerical-control system uses a word-address system, to encode information, and the tape is prepared with an EDP typewriter, such as the Friden Flexowriter. A simple language is used for coding. Alphabetical abbreviations provide functional designations, while numerical information is used to specify speeds, feed rates, and distance measurements.

Distances are in actual decimal dimensions while speed and feed numbers refer to steps in the feed-speed selection range rather than to actual speed. For example, from the 24 forward (12 reverse) speeds selectable by hydraulically actuated friction clutches, the speed setting code 16 is 512 rpm. The range is 40 to 2000 rpm.

Reliability is a prime consideration in the new control. Mercury-wetted contact relays are used throughout the system for long, trouble-free life. All the essential circuits are designed for plug-in, "remove-and-replace" maintenance. Plug-in circuitry includes amplifiers, phase shifting in the synchro system, and the tape reader. If trouble does occur, one

of 12 to 15 indicator lights shows its source. The lights also warn of incomplete cycles and they tell the operator what is taking place at all times during the cycle.

Collisions might, accidentally, be programmed into the tape information. If this happens, a protective switch in the circuit prevents the actual collision and an indicator light on the operator's panel flashes the word "COLLISION." If the programmer asks for a dimension of 50 inches and the available motion is only two feet, another indicator light flashes "OUT OF LIMITS" and the machine stops.

As a first-operation machine, the turret lathe is only one step in the total use of the numerical-control concept. After turning a shaft, for example, it may be necessary to mill a keyway, or mill a flat, or hob a spline, or grind threads, or heat treat in succeeding operations. If the turret lathe is the only machine in the shop capable of this short-run flexibility, only a partial advantage of the concept is possible. The economic advantage would improve if the shop included a numerically controlled "manufacturing center," for milling, drilling, boring, etc.

The 1960 Machine Tool Exposition will impressively demonstrate the revolution in manufacturing concept which has developed in just the five years since the 1955 Show pointed out the revolution in specific machine controls. Production centers comprising groups of machine-tools selected from the new numerically controlled designs at the exposition will slash by at least 50% conventional manufacturing costs.

Russian rotary transfer stops production bottlenecks

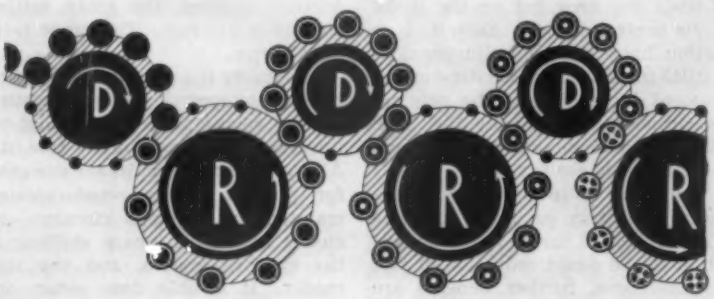
To make the rate of flow of the components in the line independent of the time required for each operation, to overcome problems in the basic design of conventional automatic lines, a new work transfer technique has been introduced in the Soviet Union. This principle can best be realized in the so-called "rotoric" unit lines. The diagram shows in principle a section of one line.

Automatic machines and lines exhibit a common pattern: Rough components enter the machine or line; are subjected to one operation or several simultaneous operations, and then are transferred to the next station for the next operation, and so on until they emerge completed. This method has two disadvantages. In the first place, the time required for transferring the component from station to station is nonproductive, that is "idle" time, and secondly the speed of the line is fixed by the speed of the slowest station, which results in a further loss in productivity.

Attempts to reduce this loss include combining operations in one station but this brings the penalty of more complex equipment. Other troubles may come from splitting a single line into two parallel lines and subsequently recombining them. In spite of measures such as these it is not practical to "tune" a line (or a machine) so that each operation is carried out under optimum conditions. Recently introduced computers for programming automatic lines bear witness to this difficulty.

In the new arrangement (shown) components to be machined come from the left-hand end and are seen as small black circles. They enter a transfer drum D and are placed in the first operational rotor R. This rotor carries ten identical tooling set-ups, so that several (seven in the case shown) components are simultaneously machined, all being subjected to the same operation. After this operation the components, denoted by a black circle with a white ring, are taken up by the second transfer drum D and placed in the second operational rotor R, where again several components are simultaneously subjected to the same operation.

After this operation (black circle with white ring and white spot in the center) another transfer drum D takes over and so on, until the components have passed through all the stations, that is, through all the rotors R. All rotors and drums R and D are geared together so that they have the same constant peripheral speed. Machining is carried out while the components are in motion (on the rotating table R), and the small pitch (that is, the distance from one position on the drum to the next one) assures very little lost time in transfer. Moreover, the time required for any operation can be exactly allocated by simply making the respective rotor R a suitable size. The actual flow does not depend on drum size or operation duration.



Prominent Soviet experts predict a great future for these "rotoric" unit lines. Nearly five hundred such lines in 50 types have already been built for various industries, incorporating such operations as machining, pressworking, heat treating, and inspection. Productivity of these lines is said to be four to five times that of the conventional machines.

Many Soviet organizations are now designing additional lines. For example: A line for producing sixteen types of spectacle lines will make 7.5 million units annually, employing only 40 people in three shifts. Seven different lines are being designed for plastic products.

Compared with the present technology, each line will pay for itself in six months. A line with twenty operational rotors and 43 auxiliary (transfer) drums is being designed to produce 30 million dry-battery cells per year, and will pay for itself in two to three months.

Advantages of "rotoric" lines compared with conventional lines include higher productivity, less space required, and lower initial cost. The latter results because a rotor for simultaneously machining several components is cheaper than several conventional units each machining only one component at a time.

Field boring saves rock crusher

By Louis Kolenski,
Jane Engineering Co, Palisades Pk, N J

This unusual field-boring job shows that you can do accurate machining without a machine tool—if you have time and ingenuity working for you. The problem was a 450 ton/hr rock crusher in an upstate New York quarry. The machine was properly installed on a heavy concrete foundation, but the factory-bored power-shaft hole through the housing faced a blank solid wall.

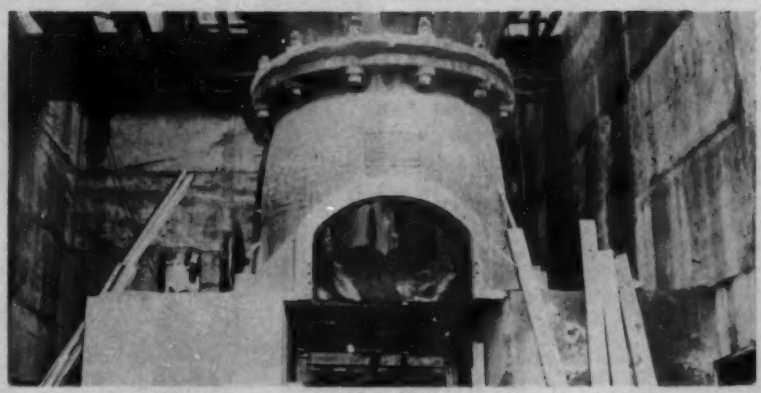
One solution was to lift the housing and turn it 90° to clear the power-shaft hole, but this would mean blasting the foundation and recasting it so the crusher outlet could face a different direction. The best solution seemed to be to field-bore the housing in the proper position.

Procedure went this way: First, two sets of pads were welded to the edges of the bosses, one pair inside, the other pair outside. These pads were complete with studs, and were mounted horizontally opposed across the hole. To the studs were mounted brackets, and then yokes with adjustable bearings were bridged across pairs of brackets to center a boring bar.

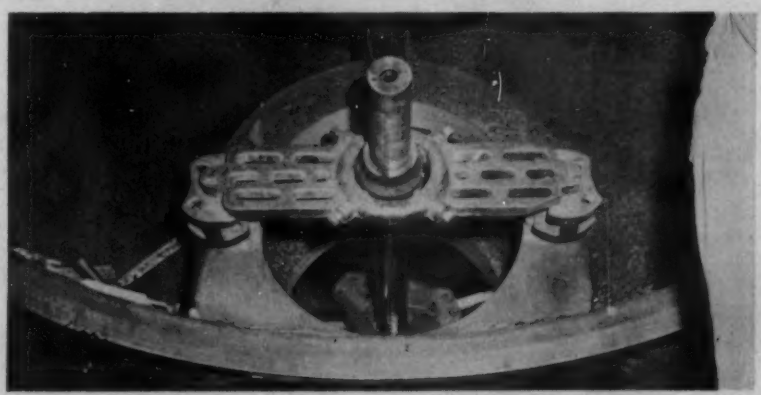
The bar was mounted and driven by gearing from an electric ¾-in. portable drill, resulting in 20 rpm at the boring bar—or about 120 sfpm cutting speed. A carbide tool (K-6) was mounted on the boring bar, and the 1-in.-deep cut was started. One wall was bored from the cored opening to 23½ in.; the other to 23¾ in. The two holes through separate wall sections were about 20 in. apart.

Alignment of the new bore was critical, and it was the most difficult part of the job. The bore had to be perpendicular to a vertical hole in the crusher, through which the main crusher spindle was to be mounted. The bore also had a critical dimension from its centerline up to the bottom of the vertical opening. We centered the bar on this hole.

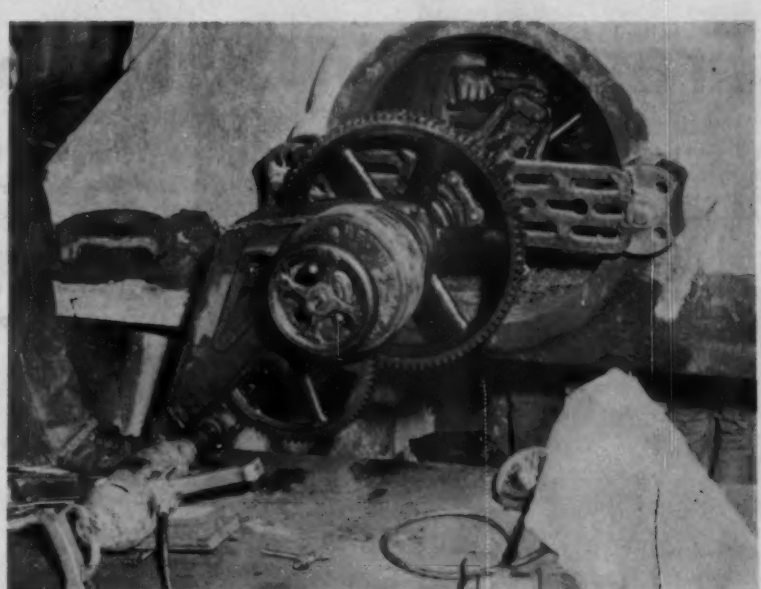
One wall in the housing had two opposed openings, so this part of the cut was interrupted. Cutting through the cast-iron scale was also some trouble. For this reason the feed box was disengaged from the leadscrew in the boring bar, and we hand-fed the tool. After considerable adjustment, both before and during the cutting action, the job was finished with the bore aligned within 0.005 in.



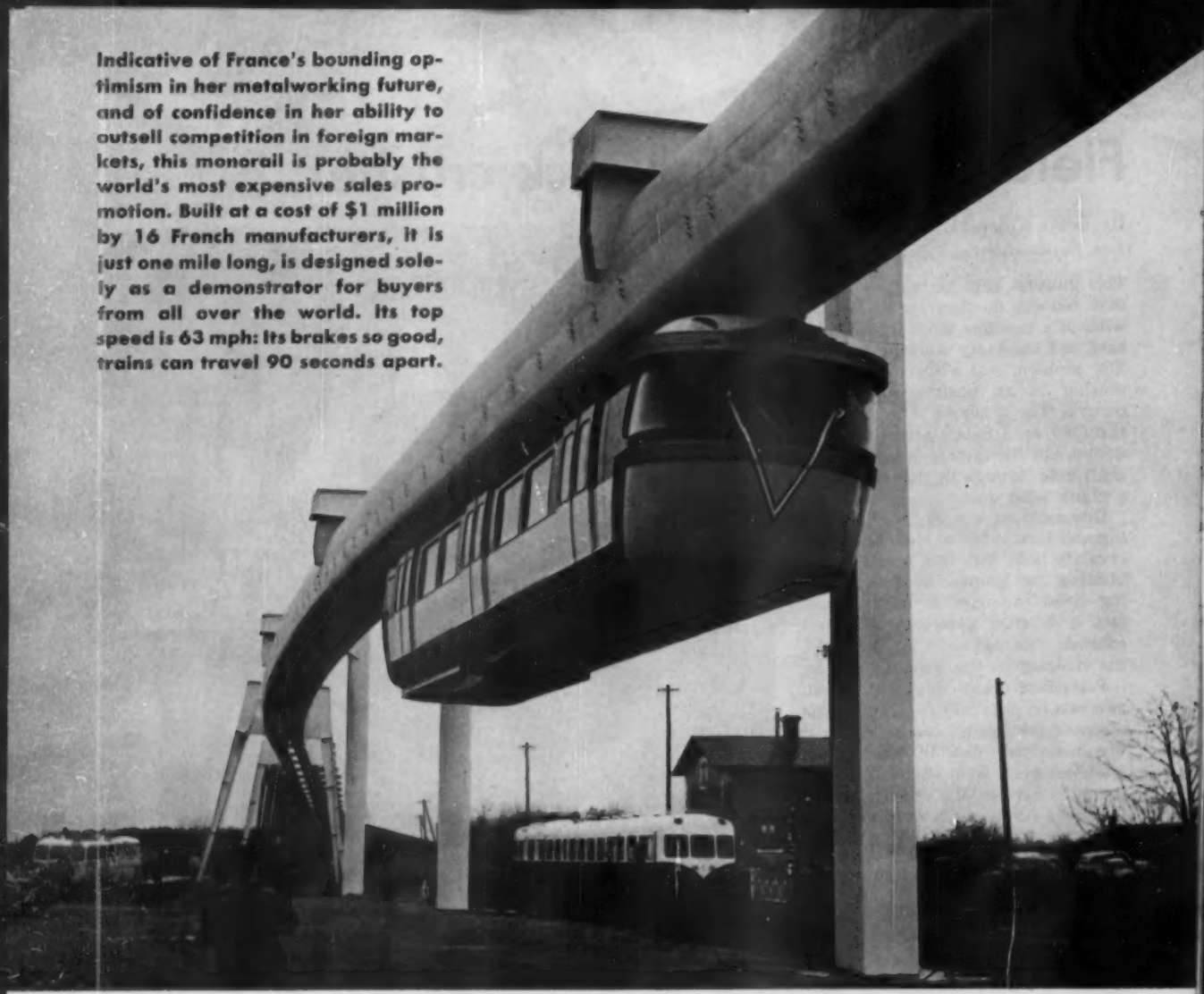
Crusher housing is installed on concrete base, but hole for power shaft is through right side, where it should be through back wall



Boring bar is mounted in adjustable bearings in yokes, which are bolted to brackets left and right. Boring tool is visible to right of bar



Power train is through gearing from electric drill to bar. Feed box (front, center) was disengaged in favor of hand feed because of interrupted cut



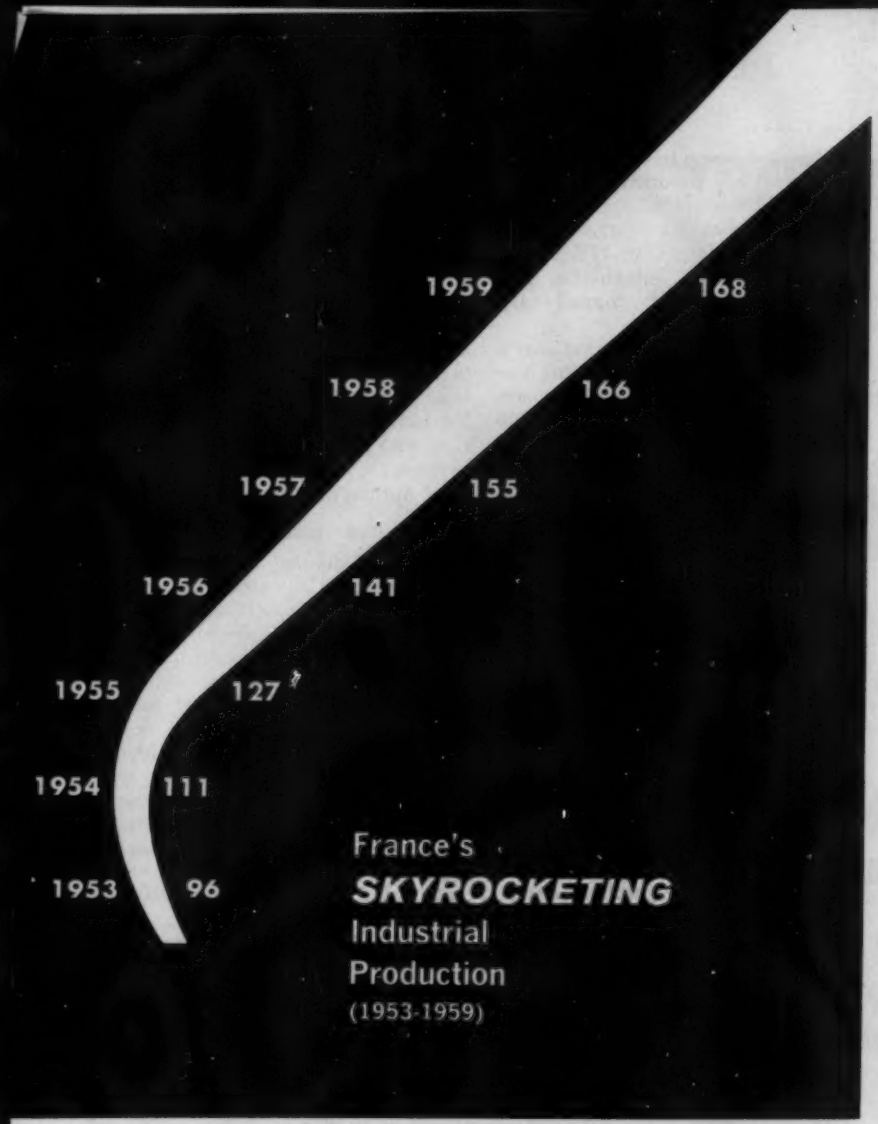
Indicative of France's bounding optimism in her metalworking future, and of confidence in her ability to outsell competition in foreign markets, this monorail is probably the world's most expensive sales promotion. Built at a cost of $1 million by 16 French manufacturers, it is just one mile long, is designed solely as a demonstrator for buyers from all over the world. Its top speed is 63 mph: Its brakes so good, trains can travel 90 seconds apart.

France—Land of soaring economy

Devastated by two World Wars, France in the last decade has undergone a startling economic and industrial renaissance. Today, everything is going up—exports, living standard, industrial output. Can France keep it up? The French think so. Here is the second in a series of on-the-scene reports from the metalworking capitals of the world

THIS METALWORKING WORLD

By Arthur Erickson
AM/MM Paris editor



Rooftops sprouting TV antennas, bustling traffic, a countryside dotted with new factories—even the most casual observer can spot the outward signs of France's postwar industrial renaissance.

France is booming.

France is well on its way to becoming a major industrial power.

France is a nation to be reckoned with in world markets.

The sky is the limit, or so the French themselves think. They point with pride to their industrial production index, which has skyrocketed from 100 in 1952 to around 170 this year, and to doubled dollar volume in the same period. Industrial sales hit the $10 billion mark last year, exclusive of the aviation industry (which by some quirk of French bookkeeping isn't counted in), which accounted for another $400 million in sales.

Unlike the British, the French are confident that their boom will go on and on. Domestic demand for such metalworking products as automobiles (there is still only one car for every eight people, compared with one for every three in the U S), and appliances is apparently insatiable.

And France is already making its mark in world metalworking markets. Example: The spectacular rise of the Renault Dauphine, which is giving Germany's best-selling Volgswagen a real run for its money in many parts of the world. The country stands to benefit greatly from the European Common Market setup, particularly because it is entering the Market with a franc that is stable for the first time since before World War II.

Like Russia, France has its five-year plans, is just about to wind up its third. When the results are in, it looks as though the manufacturing industries will fall just a little short of the goals set for them, in spite of a spectacular production rise over the last few years. Reason is that a recession that started in the last half of 1958 flattened out production and sales curves for just about every industry except automobiles.

Because of the recession, government-industry planning teams have had to work out new goals for the last 18 months of the five-year period, which ends next year. For instance, targets have been moved up for such "wonder" industries as automobiles and household appliances, whose growth despite the recession topped planned goals. On the other hand, sights have been lowered for such heel-dragging sections as industrial equipment and machine tools.

"Lusty" boom ahead

Although the men who keep tabs in French metalworking are inclined to hedge when asked to predict growth after 1961, indications point to lusty expansion over the next five years or so. Most significant, too, is the spectacular success of a drive to step up exports. In less than two years, this has helped build up France's foreign exchange reserves from next to nothing to nearly $2 billion.

Most of the export boom can be attributed to automobiles, which because of foreign sales continued to boom despite a recession at home. Now other industries are jumping aboard the export bandwagon.

Twenty hand-tool manufacturers, for example, set up an export marketing organization and launched an aggressive campaign to move in on foreign markets. Then a group of 16 materials handling equipment manufacturers followed suit in the "Manupex" combine, and 11 electrical equipment makers banded together under the name "Exportelec."

Efforts like this have already paid off: In 1950 alone, mechanical and electrical manufacturing exports totalled $1.1 billion, topping imports by $430 million.

Another tipoff on the solid economic growth that France can expect in the next few years is to be found in French reaction to the European Common Market. As little as two years ago, Eucom loomed as a bugaboo to many metalworking industries. Since then it has turned out to be a boon.

Faced with the prospect of stiff competition from West Germany, French manufacturers have been stripping the fat off their production and marketing setups. For example, four top electric motor manufacturers split up the range from fractional

horsepower to 50 hp into four parts, so that each could concentrate production on a narrow spread of sizes. Now, the entire line is marketed under a single name.

Later, a small group of refrigerator manufacturers took the same production tack, but retained their individual brand names. All the compressor units for four brands are manufactured in one plant, incidentally.

Working agreements like these, along with outright mergers, have cropped up in most metalworking sectors, and have brought with them sharply improved competitive positions for the firms involved.

Living standard soars

So far we have talked about two major French growth factors, exports and the Common Market. Now for a third: continuous upgrading of the French standard of living. Consumer durable markets (notably autos and appliances) are anything but saturated. Even the hardest-headed economist now thinks consumer buying will expand about 4% a year from now through 1965.

At this level, enough of the national product can be plowed back into new plant each year to keep French production highly competitive in the European Common Market and elsewhere in the world. In fact, export levels could very well be boosted to a point that would make the economy recession-proof. At the very least, if these predictions hold up, French metalworking is due for a five-year boom.

American companies are now cutting themselves in for a share of France's phenomenal growth, Some, like General Motor's French subsidiary (which started producing refrigerators in 1948 and has since become the top manufacturer in the country) have been around a long time. Others, like J I Case and John Deere, both farm equipment makers, have moved in recently under the impetus of the Common Market.

At 1959's end, there were about 40 U S companies operating metalworking plants in France. Total U S investment in France, across the industrial spectrum, rose from $227 million a decade ago to an estimated $527 million in 1959. Most experts think the uptrend will continue for a few years at least.

A rundown of some major sectors of French metalworking shows automobile producers far and away the pacesetters. The automakers' Jack-and-the-Beanstalk performance over the last few years has bounced auto, truck and bus production up from 1950's 357,700 units to 1959's 1,283,000 . . . and so far this year, output is running something like 17% ahead of 1959. Sales of automobiles and scooters last year topped $26 billion.

Much of the auto industry's growth comes from a sparkling export record. As little as five years ago, sales abroad totalled 129,700 units. By the end of 1959, totals had zoomed to 545,000 units. Right now, every other car that rolls off French production lines is tagged for delivery abroad.

These impressive production and export gains are the payoff of a drive by French manufacturers to modernize both their plants and their marketing setups—and in some respects the French have pulled ahead of U S auto manufacturers.

Take for example Renault's Flins plant, the most spectacular auto assembly setup in the country. Here, even the scrap handling facilities under the press lines are automated. And at Simca's Poissy plant, automatic lines perform operations ranging from heat treating to final assembly in a plant where the average age of machine tools is under five years.

The drive toward better automotive production facilities shows no signs of slacking off. For example: Renault last fall started up a plant near Rouen, concentrating its gearbox production there. Current output of two assembly lines is 120 finished gearboxes an hour. Citroen has a $25-million plant in the works outside Rennes, will start manufacturing this fall. Peugeot, fourth-ranking French auto giant, has pushed up its plant investment to 6% of sales volume. All told, the automotive and cycle industries pumped about $96 million into new plant and equipment last year.

Aircraft exports rise

Automakers are not the only ones to have received a sharp production boost from zooming exports over the last few years—France's aircraft industry has seen a steady rise in exports, even though its total sales have remained fairly stable over the years at around $400 million. Last year alone, French aviation exports rose $8 million to a record $86 million. This year should see double that figure. Pacesetter among French aviation exports is the twin-jet passenger liner Caravelle. Orders for the Caravelle (built by state-owned Sud Aviation, France's largest aircraft manufacturer — 22,000 employees) are reaching 100 units. Only 24 are accounted for by Air France: the rest have been sold to half a dozen foreign airlines, including 20 to United Airlines.

With nearly a third of the aircraft industry's 85,000 employees involved in Caravelle production, it is easy to see how this single project has led the industry into its new exporting role, and into expansion. Plant investment for the industry hit the $22.5-million mark last year.

Unsaturated appliance market

Unlike France's automotive and aircraft industries, which have gotten a tremendous boost from growing exports, the country's appliance manufacturers have been content to tap a fast-growing domestic market. They've done very well at it, too—pushing sales and production well beyond goals set by the Third Plan.

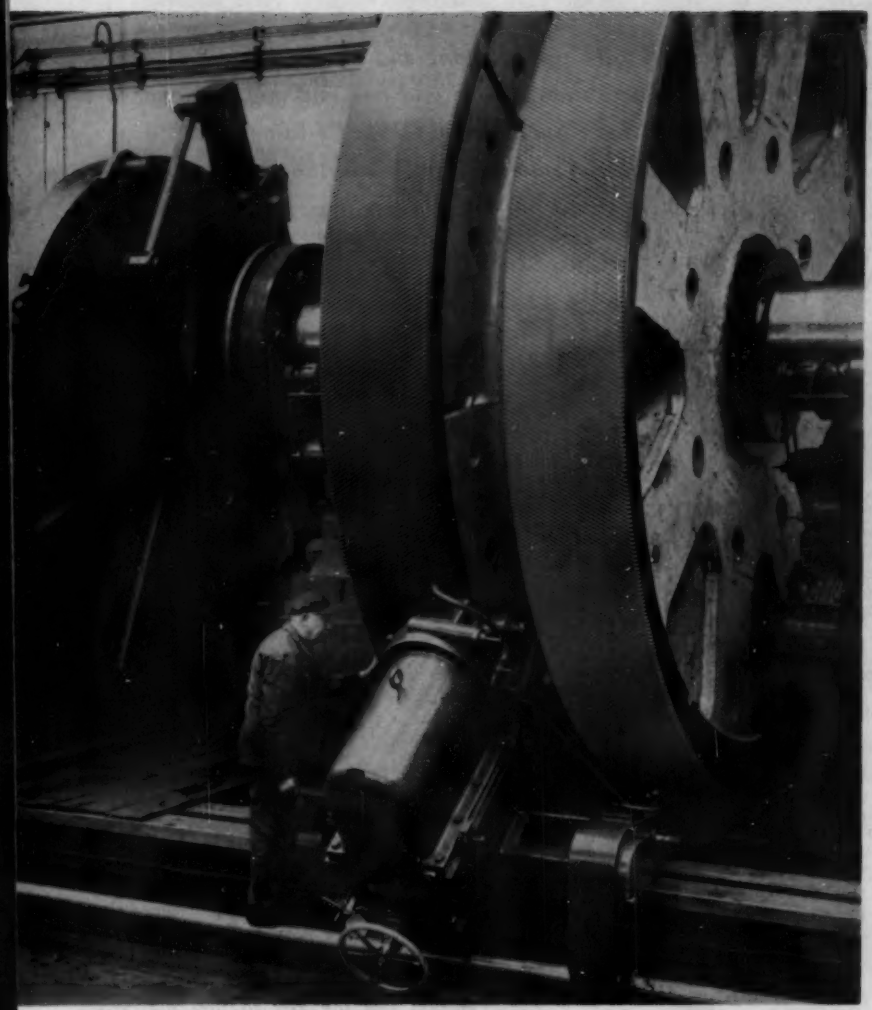
Refrigerator sales, throttled by 1958's recession, picked up again last year, when manufacturers turned out 725,000 units. Along with the increase in the domestic market, refrigerator makers increased exports by 40,000 units.

How fast refrigerator manufacturers have been growing can be judged by a look at the record of GM's French subsidiary, which has made Frigidaire as much a household word in France as Hoover is in England. In 1950 GM-France built just under 15,000 refrigerators—a decade later output had increased tenfold.

In spite of mushrooming appliance sales over the last decade, the market potential has just been scratched. Marketing men peg current saturation of the refrigerator market at 22%, washers at 21%. And, they point out, 95 out of 100 French households are wired for electricity. TV set makers, whose annual output shot up in the last five years from 186,000 to 509,000 sets, should continue onward and upward.

Says one washing machine maker, "Every time the TV network is extended to cover a new area, our sales there drop 20%. The consumers buy television sets and take their washing to a laundromat."

There is no doubt about it, the performance of France's consumer industries has been sensational and their outlook is no less sensational. The performance of more-basic industries, such as electrical machinery manufacturing, has been one of solid, rather than headline-stealing growth.



Long-famed for its prototypes and for such spectacular one-of-a-kind metalworking feats as this 16-foot main reduction gear for the passenger liner "France," French industry has in the last few years become a sensational mass-producer as well. Incidentally, the reduction gear, built by Compagnie Electro-Magnetique, was produced in a controlled-atmosphere shop, where it was automatically shaved on a special unit to 0.0004 inch tolerance

A look at the industrial form chart for 1959 shows rotating machinery sales at $145 million, more than triple the 1949 figure. On the production index this works out as a rise from 100 to just under 200.

Star performers in the electrical machinery group are the locomotive makers, whose technique has brought them world speed records and a rise in production index from 100 (base 1949) to over 500.

On the whole, electrical manufacturing industries (including electronics) have been plowing back 4.5% of sales into new plant.

Heavy industrial equipment makers, on the other hand, as a group have not built up their output as fast as the economy's planners thought they should. Slated to reach a production index of 135 (1956=100) by the end of 1961, this group was pegged at 127 last year, and growth rate was tapered off to such an extent that the goal was shaved down to 132. Other foot-dragging sectors of the economy, whose expansion was braked sharply by the recession, are agricultural equipment and machine tools.

Wage rates in French metalworking have kept pace with the steeply rising production curve over the last few years. At 1959's end, the hourly wage rate index for the Paris area, which was 100 in 1949, hit 284. A tight but not-too-seriously short labor market marked the period—one in which strikes had no significant effect on output. Work stoppages in the last two years, for example, totalled 660,000 man days in the mechanical and electrical manufacturing industries. Averaged out, this represents less than half a day per year for each of the 947,000 hourly employees in those industries.

Under the collective bargaining convention for the metalworking industries in the Paris area, basic hourly wages (including bonuses and premiums but not overtime pay) range from 41.5¢ an hour for the unskilled worker up to 70¢ an hour for highly skilled.

Those fringe benefits!

These average hourly rates are deceptively low: employers top them with something like 40% more in fringe benefits such as vacation pay and contributions to an extensive social security plan, which includes health insurance, maternity insurance, workmen's compensation, "family benefits" for employed heads of families with two or more children, "single wage" benefits paid to households with only one wage earner, and old-age pensions.

The government has set the basic workweek at 40 hours, with a 25% overtime premium for the first eight hours after that and a 50% premium after 48 hours. Average workweek in the metalworking industries has held fairly steady at about 46 hours over the last few years. Now the trend is toward a shorter week.

French wage rates over the next few years will move up in proportion to industrial growth—if government-industry planning groups have their say. The growth pattern they've plotted for the Fourth Plan (1962-1965) pegs the safe rise in consumer demand at about 4% a year. The government apparently aims to keep the lid on wage increases as well as it can, so as to stay within that 4% limit. At that rate, the economy would have enough left over for the plant investment needed to keep productivity on the upgrade.

Probably the best clue to the future growth of France metalworking lies in the confident attitude that prevails in most industries.

One French executive recently said, "France used to be a country that made sensational prototypes—now we've found we can be sensational producers and exporters as well. We've lost our industrial inferiority complex vis a vis the Germans in the process."

Holt, Rinehart, & Winston

"What's one and one and one and one and one and one and one and one and one and one?"
"I don't know," said Alice. "I lost count."
"She can't do addition," said the Red Queen.
—LEWIS CARROLL

1+1=10 or Binary numbers made easy

By James Peacock, assistant editor

Machines can count—and remember and compare—better and faster than people.

The control systems now being applied to machine tools do all their counting in an arithmetic system that uses only ones and zeros. This system, which is the idea behind all the "thinking machines" we have today, is the simplest method of counting that exists. **It is the method of writing numbers on which numerical control depends. We call it binary arithmetic.**

This binary (based on two) arithmetic is easy—even fascinating—yet it underlies all those perplexing terms like digital programming, random-access magnetic core memories, punched tape, numerically controlled machines, binary coded input—you think of one of the new terms that's been thrown at you lately and we can probably trace this arithmetic to the base of it. But the hardest part of this whole concept in mathematics is adding one and one and getting two (in binary language).

Perhaps, however, we'd best clarify things a little, and outline this whole system more thoroughly.

One and one is two; but, in binary form, we write it

$$1 + 1 = 10$$

Look strange? Probably so, but let's see what we mean. Perhaps the easiest way to do this is first to take a look at our everyday decimal system, because, except for particulars, it has all the characteristics—with many more complexities—of the binary system we wish to examine.

What do we mean when we write a number like 3784? It's simple, you say: We mean three thousand, seven hundred, eighty-four. That's right.

$$\begin{array}{r} 3000 \\ 700 \\ 80 \\ +\ 4 \\ \hline \end{array}$$

We might have written this as:

$$\begin{array}{r} 3 \times 1000 \\ 7 \times 100 \\ 8 \times 10 \\ +4 \times 1 \\ \hline \end{array}$$

In the latter form the meaning of *digits* and *position* in the decimal system begins to be clear.

The digits—the 0, 1, 2, 3, . . ., 9 that we use every day—are simply ten symbols for the ideas of zero and the first nine numbers encountered in counting. They are dimensionless symbols for certain ideas that we call numbers. And there certainly was no need to stop with nine; we could have invented symbols up just as far as we would like to go. Down through the years since man has been writing, our ten symbols have more or less evolved—not as a matter of necessity, but simply as a matter of choice and to a certain extent convenience. But they are with us, there are ten of them, and therefore, borrowing a word from our Latin ancestors, we call the system they are used in the decimal or base ten system.

And what do we mean by "base ten"? In our last tabulation of the decimal number 3784 above, we had a column of digits, each multiplied by some number like 1000, 100, 10, 1. A moment's reflection will bring to mind the fact that these are each powers of ten: 10^3, 10^2, 10^1, 10^0. Herein lies the key to any digital (using digits) number system. *The position of a digit in a number tells what power the base is to be raised to before it is multiplied by the digit and summed with all the other similar quantities in the number.*

With this in mind, let's take a closer look at the binary system. First, the word binary. As in the case of decimal, the word binary can be credited to the Latin, and means, simply, based on two. Therefore, two is the base of this system, and it follows that there will be two digits. (In any digital number system, the number of digits is always the same as the base.) We use, simply for convenience, the symbols for zero and one that are used in the decimal system. Computation is quite easy in the binary system, because the multiplication and addition tables are so short:

• Multiplication is exactly the same as in the decimal system—there just isn't so much of it. We

have only three things to remember:

$$0 \times 0 = 0$$
$$0 \times 1 = 0$$
$$1 \times 1 = 1.$$

That's all—just those three things.

• Addition is almost the same. As in the decimal system, the first two parts of the addition tables are:

$$0 + 0 = 0$$
$$0 + 1 = 1.$$

The third (and last) entry in our table—the addition of 1 and 1—could possibly cause a little difficulty unless we are careful. We only have the two digits one and zero, so let's see what happens. Since one plus one cannot be one (we have already said that one plus *zero* is one) then it must be a number that ends in zero. It isn't zero, so it must be the next biggest number—10. Therefore, the last entry is:

$$1 + 1 = 10$$
(or: $1 + 1 = 0$, carry 1).

It might clarify things a little to look at the similar case in the decimal system. What happens when we add one and nine? We have run out of separate digits, so we must write a zero in the last place, and move over to the next largest number—10.

Going back to the binary system, let's look carefully at what our numbers mean. In the decimal system, reading right to left, we have a ones digit, a tens digit, a hundreds digit, a thousands digit, *ad infinitum*. In the same manner, our binary system has a ones digit, a twos digit, a fours digit, an eights digit, a sixteens digit, *et cetera*. For example: the number 101 (binary) means simply one one, no twos, and one four—which adds up to five; the number 10010 means no ones, one two, no fours, no eights, and one sixteen—which gives us eighteen. A quick look at Table 1 —which shows some binary numbers, what they stand for, and finally what decimal number they are equivalent to—should remove any mix-ups that may still be in mind.

Up to this point, we have been changing from binary to decimal representation. Therefore, we might look for a minute at the reverse of this process, and then try a few examples before we go on to discuss binary arithmetic and its importance in computers and numerical control. Working with binary numbers of any appreciable size practically necessitates a knowledge of, or a table of, the powers of two. We have printed one (Table 2) for some smaller powers, and will confine our examples to numbers within this range.

Table 1

A few, random binary numbers, broken down to show how they are constructed, what they mean, and what decimal numbers they are equivalent to.

Binary Number	Construction of the number									What it means (decimally)	Decimal Number
	512	128	64	32	16	8	4	2	1		
101							1	0	1	4 + 1	5
11011					1	1	0	1	1	16 + 8 + 2 + 1	27
1010010			1	0	1	0	0	1	0	64 + 16 + 2	82
1010010010	1	0	1	0	1	0	0	1	0	512 + 64 + 16 + 2	594
1001						1	0	0	1	8 + 1	9
10000010		1	0	0	0	0	0	1	0	128 + 2	130
10								1	0	2	2
10111					1	0	1	1	1	16 + 4 + 2 + 1	23

Table 2

n (exponent of two)	2^n (binary representation)	2^n (decimal representation)
0	1	1
1	2	10
2	4	100
3	8	1000
4	16	10000
5	32	100000
6	64	1000000
7	128	10000000
8	256	100000000
9	512	1000000000
10	1024	10000000000

Now, let's consider converting a decimal number into its binary equivalent. We can probably do this best with an example or two. First, let's consider a rather small number like forty-seven. We know that every binary number will start with one, so we first wish to find the number of digits that will be in our number. We look at Table 2 and see that 47 lies between 32 and 64 in the decimal representations of powers of two. Therefore (This is a logical rule, which may be figured out with a brief examination of the binary representations of powers of two.), since 32 corresponds to the fifth power of two, there will be five digits following the one in our number. We write

1 _ _ _ _ _

and proceed to fill in the blanks.

The next step is to subtract 32 from 47. This gives us 15. Since 15 is not so large as 16 (the power of two next lower than 32), our next digit will be a zero; since 15 is larger than 8, our third digit (from the left) will be a one. Therefore, we have (to date)

1 0 1 _ _ _ .

To get the next digits, we subtract 8 from 15. This gives us 7. Since 7 is larger than 4, our next digit is a one. Continuing, we subtract 4 from 7, getting 3 (which is larger than 2) and another one. Finally, subtracting 2 from 3 gives 1, which says that our last digit is also a one. Therefore, our number is

1 0 1 1 1 1.

We can check ourselves. The number 101111 means

$$\begin{array}{r} 1 \\ 2 \\ 4 \\ 8 \\ +32 \\ \hline 47. \end{array}$$

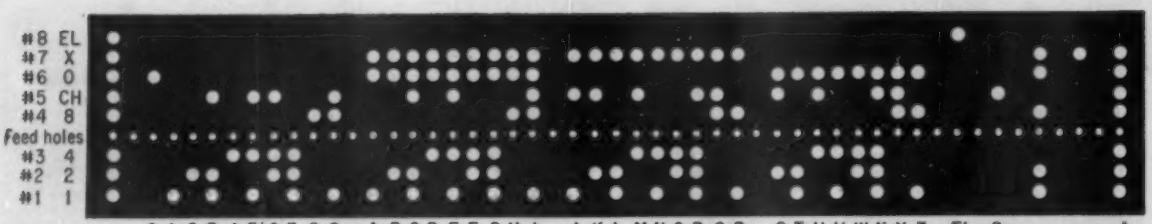
We summarize our method as follows:

• The first (left-most) digit of the binary number will be a one.

• Take the given decimal number and, looking in Table 2 at the decimal representations, find what power of two is equal to or next less than the given number. The exponent for this

XXV	=	25	=	11001
Roman		Decimal		Binary

Numbers are simply symbols for an abstract quantity, and may be written in any number of different systems. This article discusses one of these, called the binary number system.



The bottom four rows of holes designate position in a binary number—a hole is a one, no hole is a zero. For letters, we use the numbers one through nine, in conjunction with one or more auxiliary symbols (on the four top rows). A-I are written 1-9 with both the "X" and "O" holes punched; J-R are written 1-9 with only the "X" hole punched; S-Z are written 2-9 with only the "O" hole punched. The "EL" hole is punched only at the end of each instruction to machine. The "CH" hole, which is punched automatically by the Flexowriter when it is needed, is used to insure that there is always an odd number of holes punched in the tape; this acts as an automatic checking device as tape is read into machine. Codes for space (sp), decimal point (.), dash (–), and feed (f) are as shown. The feed signal causes read-in device to skip over that line; therefore, errors are corrected by "blanking out" (filling with holes) a line.

power (the "n" that corresponds to it) will be the number of digits that follow the first "1".

• From the given number, subtract the power of two found above. Compare this result with the table. Three conditions may exist:

a) If it is larger than the next lower power of two, the second (from the left) digit will be a one, and we repeat the process.

b) If it is equal to the next lower power of two, the second (from the left) digit will be a one and the rest will be zeros.

c) If it is smaller than the next lower power of two, there will be as many zeros as powers of two which are larger than it, then there will be a one, and we repeat the process.

One more example, with brief explanations, should clear everything up: 1602—larger than 1024 (2_{10}), therefore we have

```
    1_________
 1602
-1024
 ----
  578—larger than 512, therefore
    1 1_______.

  578
- 512
 ----
   66—smaller than 256 and 128;
larger than 64; therefore
    1 1 0 0 1_____.

   66
-  64
 ----
    2— smaller than 32, 16, 8, and 4;
equal to 2, therefore
    1 1 0 0 1 0 0 0 0 1 0.
```

Multiplication and addition are quite easy—the important thing to remember is the carry (which may happen several times in one column) in the addition. However, since the machines do almost all of this work for us, it should suffice to run through only a few examples. Adding five and seventeen would come out, in binary system (with decimal meaning shown):

```
  101  ( 4 + 1)
10001  (16 + 1)
-----
10110  (16 + 4 + 2).
```

Addition of a small column will show the carry problem (carried ones are are shown in bold face):

```
   11
  110   (2)
  110   (4 + 2)
 1101   (4 + 1)
 1 11   (2 + 1)
-----
10000.
```

Multiplication is just as easy. Consider twelve times fifteen:

```
 1111   ( 8 + 4 + 2 + 1)
x1100   ( 8 + 4)
------
11110   ( 32 + 16 +  8 + 4)
1111    ( 64 + 32 + 16 + 8)
------
10110100. (128 + 32 + 16 + 4)
```

Admittedly, this base two system has a disadvantage for everyday use: A relatively small number, like the one-hundred eighty above, has a rather long representation, as 10110100. You can imagine what numbers used in business transactions would look like. However, this system has an advantage (besides the simplicity of its arithmetic tables) that far outweighs this rather clumsy number length. The two digits lend themselves very well to electrical and mechanical representation: on or off, current flow or no current flow, positive or negative magnetization, hole or no hole. Primarily for these reasons, the binary system of arithmetic is the heart of all the electronic mysteries that surround us today.

Computers do little more than add. Let's explore this statement.

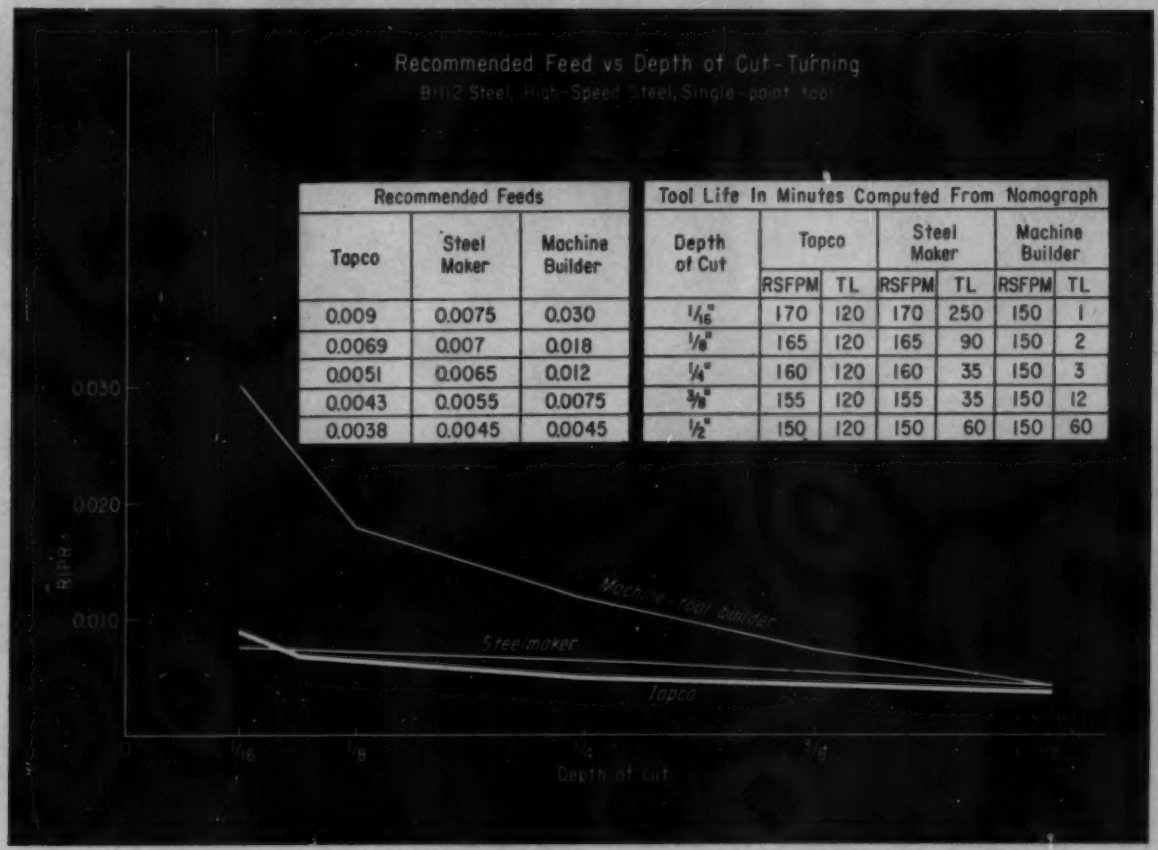
A computer is very much like a well-organized accountant's office. It has many filing cabinets, called the memory; it has built-in adding machines, which can also subtract, multiply, and divide; and, like a good employee who would work in the office, it can look up information, follow instructions, perform arithmetical operations on the information, make simple decisions—such as whether a number is positive or negative, or is larger or smaller than a given quantity—and store its results in the proper place. It doesn't make mistakes; it is painstakingly patient about doing very boring or repetitive tasks; it works at a fantastically fast speed.

Without binary numbers, a digital computer would only be a pretty box. All information is put into the computer in "words" which are measured in "bits"—the number of binary digits these words contain. Sometimes, however, the computer has built-in units which "translate" information from decimal to binary representation; in this case, information appears to be inserted in decimal form, but the actual computer itself —the part that does the storage and performs the operations—uses only binary arithmetic. All operations are done in binary form, from words—"pieces of information"—which are either magnetized spots or electrical pulses—either there or not there, as a bit is a one or a zero.

Binary numbers are also vital to numerical control equipment. Although most of these systems don't carry out internal calculations, the tapes (or other input media) which control them are written in binary form—with holes in the tape standing for ones and no holes implying zeros. Numbers are written directly; code letters are simply numbers with an extra "guide" hole or two; special meaning is assigned to certain letters, and when this letter comes into the machine, a certain action is carried out—using the numerical data fed in binary form into the memory or instruction unit. The typical punched-tape coding system described above should explain how punched tape will be used in controlling many of your machines.

Now...a foolproof formula for Consistent feeds and speeds

By Tom Johnson, associate editor



Recommended Feeds		
Tapco	Steel Maker	Machine Builder
0.009	0.0075	0.030
0.0069	0.007	0.018
0.0051	0.0065	0.012
0.0043	0.0055	0.0075
0.0038	0.0045	0.0045

Tool Life In Minutes Computed From Nomograph						
Depth of Cut	Tapco		Steel Maker		Machine Builder	
	RSFPM	TL	RSFPM	TL	RSFPM	TL
1/16"	170	120	170	250	150	1
1/8"	165	120	165	90	150	2
1/4"	160	120	160	35	150	3
3/8"	155	120	155	35	150	12
1/2"	150	120	150	60	150	60

A significant break-through in speed-feed calculation. This is our opinion of a new procedure that gives the engineer a consistent way to get consistent speeds and feeds for any job-shop machining operation. Developed for the Tapco Measured Standard Data Program, the procedure approaches the subject from a new standpoint: Tables are based on a constant tool life. With a manual, proved in practice, anyone can derive speed-feed formulas, as well as time standards, in a matter of minutes. All he must do is fill out a simple worksheet. Here is a detailed description of the way the procedure works—in theory and in practice.

American Machinist / Metalworking Manufacturing

Special Report No. 493 • July 25, 1960

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Consistent feeds and speeds . . .

• Is there a consistent way to correlate all the major variables that affect cutting?

• Is there a quick way to get workable speeds and feeds for job-shop machining operations?

• Can everyone derive these workable speeds and feeds consistently—without guesswork?

A year ago all three of these questions, of major importance to any job shop, would have been difficult to answer—affirmatively. Look at any series of speed-feed recommendations for a machining operation, and you will discover that the only thing they have in common, usually, is inconsistency. When any ten engineers look at a specification, they are likely to come up with ten different sets of recommended speeds and feeds.

The reason for these often-wide variations is not hard to find: Each source bases its speed-feed experiments upon different assumptions. When a cutting-tool manufacturer recommends speeds and feeds, he is chiefly concerned with tool life. A machine-tool builder, on the other hand, thinks about his machine's capability when he develops suggested speeds and feeds. And research laboratories may derive formulas that, theoretically perfect, are not practical for shop use.

Today a new procedure, claimed to be the first of its kind, resolves all these inconsistencies. Feed-speed calculation—done all too often by hit-or-miss estimating or arbitrary assumption—becomes a simple matter of filling out a form with data from a manual. And everyone who fills out the form will derive exactly the same speeds and feeds.

Behind the procedure's success is an approach that departs significantly from other speed-feed calculations. Tables are *not* based upon a constant metal-removal rate, for example, nor upon machine capability.

The new approach: To machine almost any metal on any machine tool, with any type of cutting tool, relate feeds and speeds to a constant tool life. When tool life is the constant, a consistent way to get consistent feeds and speeds becomes possible.

History of the program

The speed-feed formulas based on a constant tool life are a major section in the Tapco Measured Standard Data Program. As the name indicates, the technique was developed at the Tapco Group (Cleveland, Ohio) of Thompson Ramo Wooldridge Inc. Participating with a Tapco team were experts from the Serge A Birn Co, consulting management engineers, whose headquarters are in Louisville, Ky. A Birn Co engineer, Ralph W Eastwood, was responsible for the concept of the data.

One striking feature of the procedure is that, unlike many standards programs, it did not take years to develop. In June 1959, a small Tapco team headed by A E Stukey (Supervisor, I E Budgets and Standards) began work on the project. Collaborating with a Serge A Birn group headed by Executive Vice President R M Crossan, who is widely known for his experience in measured standards programs, the team completed its work before the end of November.

Actually, the machine-time data was fully developed by August of 1959. And the entire program includes not only machine-process data, but standards for manual handling as well. 231 man-weeks of time went into the project, which cost Tapco $75,000 (although it had been budgeted at $85,000).

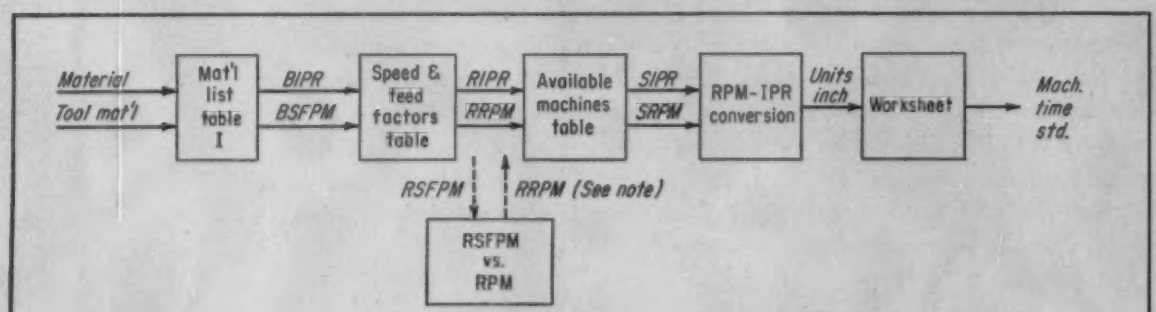
Results have been impressive. Since October 1959, the technique has been put to work in four of Tapco's Cleveland Works. Art Stukey and his chief machine-time aide, Industrial Engineer John E Swift, state flatly: "We have not yet found a major flaw in our tables. So far, we've been able to trace all complaints to such errors as faulty tool geometry or faulty clamping—not to the basic procedure."

One further point deserves mention here. In addition to machine-time data, the tables provide predetermined elemental time data for the manual part of the job. As such, the procedure solves the biggest remaining headache that confronts the user of predetermined standards. Until now, there has been no systematic method for obtaining predetermined standards that apply to machine-process time. The Tapco research thus has resulted in the first *complete* set of data on the subject—a set that includes standards not only for manual loading and unloading operations, but also for machining operations. At Tapco, incidentally, time standards are derived from Methods-Time Measurement studies. But the speed-feed data are valid for use with other time-study techniques.

Faster speeds and feeds

If there is a moral behind the new development, it is this: Find the most economical constant tool life in your shop, and you have the key to machining standards that are easy to develop and quick to set up.

Since the inauguration of the new system, there have been two significant results in Tapco shops:



Note – 1. For the following operations, the speed factors Factor BSFPM into RSFPM
a. Bore b. Chamfer c. Cutoff, Groove, Recess, Trepan. d. Face e. Form f. Hollow Mills g. Turn
2. For other Lathe operations, the speed factors Factor BSFPM into RRPM directly

For lathe operations speeds and feeds are determined by going through the steps outlined above. On p 118-119 is the solution to an actual machining operation, in which each of the above steps is illustrated

1. Tapco has found it practical to increase speeds and feeds quite radically. New cycle times are, by conservative estimate, 20% less than they used to be.

2. In the machining of light metals, Tapco has found that machine time could be dramatically reduced—even more than at present—if the machine could produce the required speeds. In effect, the manual has already pointed out that many machines presently in use need to be replaced.

Where the manual applies

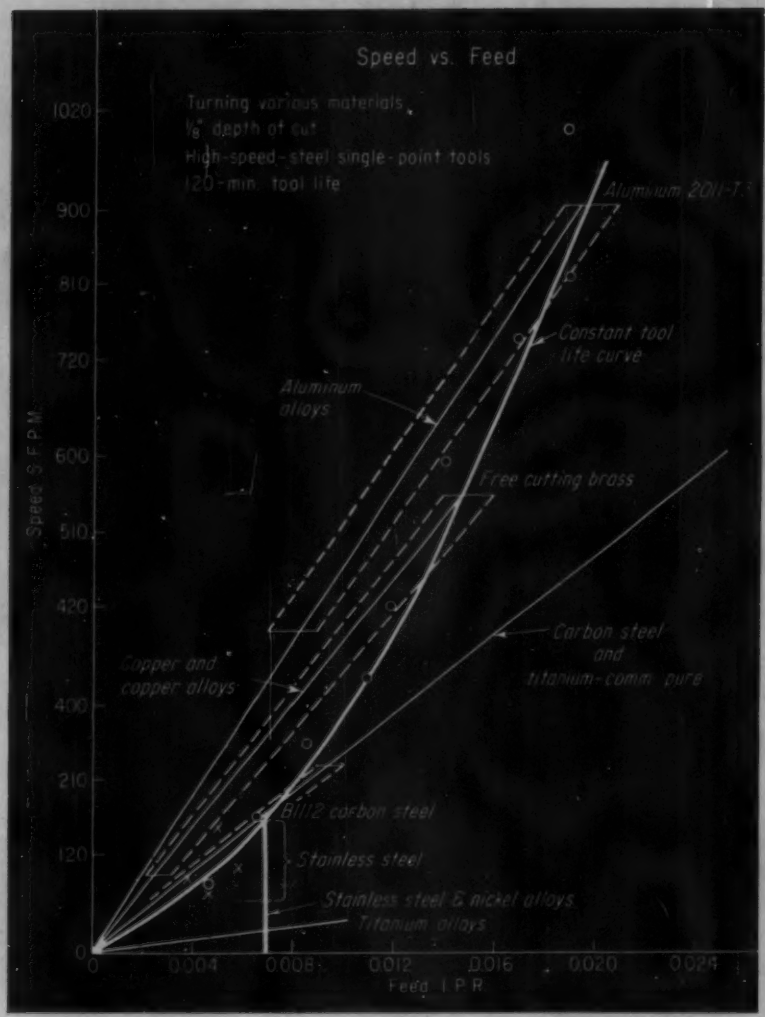
This article gives a detailed exposition of the new procedure: how the tables for speeds and feeds were developed, and how they can give the process engineer effective formulas. The following pages summarize the approach to developing the formulas. Although the Tapco program also includes formulas for manual standards, emphasis here will be upon the really significant development: feeds and speeds, with predetermined time standards, for machining operations.

The Tapco manual, incidentally, will not be available for outside use, because it does not apply to every plant. To make intelligent use of the data, a plant must tailor the procedure to fit its own needs. Although the principles of the procedure are universal, the tables that contain data *must* be adapted to the conditions of each particular company. Obviously, no two sets of conditions are identical, and there will be no such thing as identical manuals for different companies; in fact, using the manual of one company in another, without preliminary research and careful adaptation, could do more harm than good. (Birn experts claim, however, that they can adapt the procedure to any job-shop.

The procedure, then, has been proved in practice, and will work in any plant within this framework:

1. The plant must be a job shop, for the tables are not applicable to mass-production operations. (Typical Tapco products: aircraft fuel pumps, auxiliary power systems for missiles, electronic sub-assemblies.)

2. Machine times apply to conditions in the job shops of the Tapco Group. Most tables are related to machining of high-speed steel at a tool life, 120 minutes, that is most economical in those shops. In other plants data will of course vary, depending on the most economical tool life and the tools used in the shop. But the basic approach would still be the same.



Constant tool life appears on this graph as a curve. With a given speed, one can obtain a basic feed value from the constant-tool-life curve for any material. With charts like this, Tapco can establish speed-feed relationships for every material machined in its shops

3. Exacting accuracy, which some operations might call for, has been sacrificed in the interest of getting consistent speed-feed standards, of reasonably good quality, for a wide variety of operations—quickly. In its production works, Tapco can set an engineered standard in about 20 minutes. And the average toolroom standard takes only about 3 minutes to set.

Within these qualifications the manual covers a wide range of metals, tool materials, and machining operations, and the approach will cover many other situations (in the short time available, Tapco stuck to its major machining operations). And although figures are based, for the most part, upon a constant tool life of 120 minutes, Tapco can easily make adjustments that give any tool life.

Developing the tables

To construct its feed-speed tables, the Tapco-Birn team took two steps:

I. It selected a basic machining operation: turning at a ⅛-in. depth of cut. For this operation (benchmark material was B1112 steel), it found the feed and speed for machining any material with any of four types of cutting tools: high-speed, carbide, alloy, and carbon. These figures, based upon a constant tool life of 120 minutes, are listed in a "Basic Speeds and Feeds Table" (called Table I in the manual).

II. It developed other tables—one set for each type of machine tool—that relate directly to the machine tool. These tables contain factors, re-

DRILLING – HAND FEED

OPER. SIZE (H) (IN.)	SPEED FACTOR BY DEPTH IN DRILL DIA. (C)			FEED FACTOR BY MATERIAL AND DEPTH IN DRILL DIAMETERS													DRILLING-POWER FEED BY DEPTH IN DIAMETERS					
				STEEL & TITANIUM			COPPER & COPPER ALLOYS			ALUMINUM & MAGNESIUM			CAST IRON			1–5		6–10		11–16	
	1–5	6–10	11–16	1–5	6–10	11–16	1–5	6–10	11–16	1–5	6–10	11–16	1–5	6–10	11–16	SPEED (C)	FEED	SPEED (C)	FEED	SPEED (C)	FEED
1/16	34	30	25	.48	.43	.35	.48	.43	.35	.48	.43	.35	.48	.43	.35	34	.48	30	.43	25	.35
1/8	17	15	13	.59	.53	.44	.59	.53	.44	.59	.53	.44	.59	.53	.44	17	.59	15	.53	13	.44
3/16	12	10	9	.66	.58	.49	.66	.58	.49	.66	.58	.49	.66	.58	.49	12	.66	10	.58	8.6	.49
1/4	8.9	7.8	6.6	.73	.64	.54	.73	.64	.54	.73	.64	.54	.73	.64	.54	8.9	.73	7.8	.64	6.6	.54
5/16	7.1	6.2	5.3	.76	.67	.57	.76	.67	.57	.76	.67	.57	.76	.67	.57	7.1	.76	6.2	.67	5.3	.57
3/8	2.8	2.4	2.0	.36	.31	.26	.46	.40	.33	.71	.62	.51	.22	.19	.16	2.8	1.05	2.4	.92	2.0	.76
1	2.4	2.1	1.7	.31	.27	.22	.37	.32	.26	.60	.53	.43	.16	.14	.12	2.4	1.08	2.1	.95	1.8	.78
1 1/4	2.8	1.7	1.4	.23	.20	.17	.24	.21	.18	.50	.44	.37	.10	.09	.07	2.0	1.15	1.8	1.01	1.5	.83

Added Length for Drill Point
For Blind and Thru Holes Add .2 Dia. to Length of Drill Hole.

Added Length for Drill Point For Blind & Thru Holes Add .5 Dia. to length of Drill Hole.

OPER. SIZE (H) (IN.)	BORE		CHAMFER		C'BORE & SPOT FACE		C' SINK & BURR		CUTOFF GROOVE RECESS TREPAN		FACE		FORM		HOLLOW MILLS		KNURLING STOCK DIA. (IN.) 1/4	3/8	1/2	5/8	3/4	7/8	1
	SPEED	FEED	SPEED	FEED	SPEED (C)	FEED	SPEED (C)	FEED	SPEED	FEED	SPEED	FEED	SPEED	FEED	SPEED	FEED	SPEED (C)						
																	16	10	8	6	5	4	4
																	FEED						
1/16	.77	.73	1.03	1.07	29	.34	38	.27	1.00	.29	1.25	1.09	–	–	.91	1.44	.33	.44	.57	.67	.78	.89	1.02
1/8	.75	.55	1.02	1.02	15	.43	19	.33	1.06	.36	1.21	.81	–	–	.85	1.17	.24	.37	.45	.58	.71	.84	.95
3/16	.74	.48	1.02	.98	9.8	.47	13	.37	1.10	.40	1.19	.70	1.02	.43	.82	1.05	.19	.32	.43	.56	.69	.80	.86
1/4	.73	.42	1.02	.95	7.5	.52	9.8	.40	1.15	.43	1.18	.61	1.02	.41	.79	.94	.15	.24	.37	.47	.60	.71	.80
5/16	.71	.38	1.01	.92	6.1	.56	7.8	.42	1.20	.46	1.15	.56	1.01	.40	.76	.89	.06	.21	.32	.45	.55	.64	.73
3/8	.70	.35	1.01	.88	5.1	.59	6.5	.45	1.25	.49	1.14	.52	1.01	.38	.73	.85		.15	.30	.41	.49	.58	.64
7/16	.69	.32	1.00	.85	4.4	.61	5.7	.47			1.11	.49	1.00	.37				.06	.21	.30	.38	.49	.57
1/2	.68	.31	1.00	.83	3.9	.63	5.0	.49			1.10	.46	1.00	.35					.13	.23	.33	.42	.50
5/8	.66	.28	.99	.79	3.1	.67	4.1	.52			1.06	.43	.99	.34									
3/4			.99	.74	2.7	.73	3.5	.55					.98	.32									
7/8					2.4	.76	3.9	.59					.99	.31									
1					2.1	.77	2.7	.60					.98	.29									
1 1/4					1.7	.83	2.2	.64					.97	.27									
1 1/2													.96	.26									
1 3/4													.95	.25									
2													.93	.23									
2 1/4													.92	.22									
2 1/2													.91	.22									
3													.89	.21									

OPER. SIZE (H) (IN.)	REAM		TAPPING – SPEED FACTORS (C)						THREADING – SPEED FACTORS (C)						TURN	
			THREADS / INCH (B)						THREADS / INCH							
	SPEED (C)	FEED	3–8	8–14	14–24	24–36	36–56	64–UP	3–8	8–14	14–24	24–36	36–56	64–UP	SPEED	FEED
1/16	42	1.02	4.3	5.5	7.3	10	14	20	6.1	8.0	10	15.4	15.6	28	1.03	.30
1/8	21	1.26	2.1	2.7	3.7	5.5	7.3	10	3.4	4.3	5.5	8.3	10.7	15	1.0	.36
3/16	14	1.38	1.4	2.0	2.6	3.7	4.9	6.9	2.2	2.9	3.9	5.9	7.1	10.7	.98	.84
1/4	11	1.52	1.1	1.5	2.0	2.9	3.8	5.3	1.7	2.1	2.9	4.6	5.5	8.4	.97	.74
1	2.9	2.26	.34	.46	.61	.88	1.1	1.6	.57	.70	.96	1.4	1.9	2.7		
1 1/4 IN&UP	2.4	2.40	.31	.37	.52	.73	.95	1.3	.50 .43	.61 .52	.80 .70	1.2 .98	1.6 1.3	2.3 1.8		

SURFACE FINISH (J)

WORKPIECE MATERIAL	MAXIMUM FEED IN IPR. 32 RMS	63 RMS	125 RMS
Alloy and Stainless Steels (40-90 SFPM)	.005	.014	.010
Carbon and Alloy Steels (50-120 SFPM)	.004	.009	.009
Free Machining and Carbon Steels (120-200 SFPM)	.007	.007	.010
Aluminum and Copper Base Alloys	.005	.010	.010

APPLICATION NOTES

A. Length of Cut—Add .3 Inch to Print Dimension (Allowance for Length of Engagement for the Cutting Feed and Overtravel or Reduced Feed when approaching a shoulder) for Turret Lathes. For a Hardinge lathe add .2 inches to print dimension instead of .3 inches.

B. Tapping—Allow Time for two Cuts (Feed In and Out).

C. Speed Factors for Drilling, Reaming, C'Sink, Spot Face, C'Bore, Knurling, Tapping, Threading, and Burring Convert BSFPM Directly into RRPM.

D. Select a Feed Equal to or Lower than the recommended if available.

E. Select an RPM within 10% of the recommended. If not available, select the closest lower available RPM.

F. On Short Cycle Operations, (Burr, C'Sink, Spot Face, and Chamfer), avoid shifting RPM for each individual Operation. Select an RPM for these Operations corresponding to the preceding or succeeding major Operation that is closest to the recommended RPM for the short cycle operation.

G. On combinations operations using combination tools (e.g. Drill & C'Sink), Calculate and Select the RPM and Feed for the major operations being performed (Neglect the minor Auxiliary Operation). If more than one major operation is being performed by the combination tool, select one RPM for all operations (lowest recommended RPM). For Hand Feed, use the recommended feed for each operation. For Power Feed, select one feed for all operations (lowest recommended feed).

H. Operation Size:

Bore — Depth of Cut	Groove — Tool Width	Form — Tool Width	
Chamfer — Tool Width	Recess — Tool Width	Hollow Mills — Depth of Cut	
C'Bore — Hole Diameter	Trepan — Tool Width	Knurling — Tool Width	
C'Sink — Diameter	Drill — Hole Diameter	Ream — Hole Diameter	
Cut Off — Tool Width	Face — Depth of Cut	Tapping — Diameter	
Threading — Diameter 1/16" = #0-8 1/8" = #6-32		Turn — Depth of Cut	

I. Use the Speed and Feed Factors in Metal Removal for:
   a. Drill Press type operations (Drill, Ream, C'Sink)
   b. When a finishing operation follows the lathe operation roughing cuts.
   c. When the Feed is less than that given in Surface Finish Table for a specified Surface Finish.

J. When Surface Finish is a requirement for Lathe-Operations, use Speed Factors from Metal Removal Tables and Feeds given in Surface Finish Table if they are lower than feeds from Metal Removal Tables.

K. All Factors are based on Tool Life of 120 cutting minutes except Titanium Alloys which are based on 10-40 cutting minutes.

LATHE OPERATIONS

BASIC SPEED TABLE I: 225

COLUMN	1	2	3	4	5	6	7
	DIA. OF OPER.	OPER. SIZE	SPEED FACTOR	FEED FACTOR	RECOMMENDED RSFPM	RRPM	RIPR
SOURCE / OPERATION	PRINT	PRINT	TABLE G-1	TABLE G-1	I x COL. 3		II x COL. 4
Turn Dia. 7	1.575"	1/16"	1.03	1.30	232	562	.012
Turn Dia. 1-5	1.60"	1/16"	1.03	1.30	232	554	.012
Turn Dia. 4	1.565"	1/16"	1.03	1.30	232	566	.012
Turn Dia. 2	1.565"	1/16"	1.03	1.30	232	566	.012
Groove Dia. 6	1.565"	3/16"	1.10	.40	248	605	.004

NOTE: RSFPM = Recommended Surface Feet Per Minute
RRPM = Recommended Revolutions Per Minute
RIPR = Recommended Inches Per Revolution

How the procedure works in practice...

Here is an actual machining operation for which speeds and feeds, as well as time standards, are developed. The user simply fills out the worksheet (center, below) with figures from tables, then makes a few simple calculations. (See story text for explanation of tables)

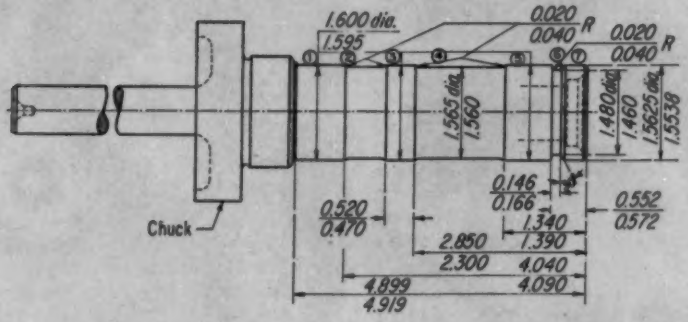


TABLE I
BASIC SPEEDS AND FEEDS
STEELS

	HIGH SPEED TOOLS		CARBIDE TOOLS		ALLOY TOOLS		CARBON TOOLS			HIGH SPEED TOOLS		CARBIDE TOOLS		ALLOY TOOLS		CARBON TOOLS	
AISI & SAE SPEC. NOS.	BASIC SFPM	BASIC FEED	BASIC SFPM	BASIC FEED	BASIC SFPM	BASIC FEED	BASIC SFPM	BASIC FEED	AISI & SAE SPEC. NOS.	BASIC SFPM	BASIC FEED	BASIC SFPM	BASIC FEED	BASIC SFPM	BASIC FEED	BASIC SFPM	BASIC FEED
C-1125	135	.0057	315	.0132	205	.0086	70	.0029	A-3150-A	100	.0042	235	.0099	150	.0063	50	.0021
C-1126	130	.0055	305	.0128	195	.0082	70	.0029	A-3240-A	95	.0040	225	.0095	145	.0061	50	.0021
C-1132	125	.0053	295	.0124	190	.0080	65	.0027	A-3310-A	85	.0036	200	.0084	130	.0055	45	.0019
C-1137	120	.0050	280	.0170	180	.0076	60	.0025	A-3361-A	80	.0034	190	.0080	120	.0050	40	.0017
C-1138	125	.0053	295	.0124	190	.0080	65	.0027	A-4023	130	.0055	305	.0128	195	.0082	70	.0029
C-1140	120	.0050	280	.0170	180	.0076	60	.0025	A-4024	130	.0055	305	.0128	195	.0082	70	.0029
C-1141	115	.0048	270	.0113	175	.0074	60	.0025	A-4027	110	.0046	260	.0109	165	.0069	55	.0023
E-2512	85	.0036	200	.0084	130	.0055	45	.0019	A-4317-A	100	.0042	235	.0099	150	.0063	50	.0021
E-2515	"	"	"	"	"	"	"	"	A-4320-A	"	"	"	"	"	"	"	"
E-2517	"	"	"	"	"	"	"	"	A-4337-A	95	.0040	225	.0095	145	.0061	50	"
A-3115	110	.0046	260	.0109	165	.0069	55	.0023	E-4337-A	90	.0038	210	.0088	135	.0057	45	.0019
A-3120	"	"	"	"	"	"	"	"	A-4340-A	95	.0040	225	.0095	145	.0061	50	.0021
A-3130	95	.0040	225	.0095	145	.0061	50	.0021	E-4342-A	85	.0036	200	.0084	130	.0055	45	.0019
A-3130-A	120	.0050	280	.0118	180	.0076	60	.0025	A-4608	110	.0046	260	.0109	165	.0069	55	.0023
A-3135	90	.0038	210	.0088	135	.0057	45	.0019	A-4615	"	"	"	"	"	"	"	"
A-3135-A	115	.0048	270	.0113	175	.0074	60	.0025	E-4617	105	.0044	245	.0103	160	.0067	55	"
A-3140	70	.0029	165	.0069	105	.0044	35	.0015	A-4620	110	.0046	260	.0109	165	.0069	55	"
A-3140-A	110	.0046	260	.0109	165	.0069	55	.0023	E-4630	105	.0044	245	.0103	160	.0067	"	"
A-3141	65	.0027	155	.0065	100	.0042	35	.0015	A-4621	110	.0046	260	.0109	165	.0069	"	"
A-3141-A	110	.0046	260	.0109	165	.0069	55	.0023	A-4640-A	"	"	"	"	"	"	"	"
A-3145-A	"	"	"	"	"	"	"	"	E-4640-A	86	.0036	200	.0084	130	.0055	45	.0019

MACHINE TIME WORKSHEET

8	9	10	11	12	13	14	15
SELECTED (Z)		TRW UNITS	LENGTH OF OPER.	LENGTH OF CUT	TIME CUT	NO. OF CUTS	TOTAL TIME
SRPM	SIPR	INCH					
TABLE L-2	TABLE L-2	1000 RPM x IPR.	PRINT	SEE NOTE A	COL. 10 x COL. 12	PRINT	COL. 13 x COL. 14
556	.012	150	.420	.720	108	1	108
556	.012	150	4.41	4.71	706	1	706
556	.012	150	.708	1.008	163	1	163
556	.012	150	.565	.865	133	1	133
556	.004	450	.055	.355	160	1	160
						TOTAL	1270

BASIC FEED TABLE I .0095

RPM = Selected Revolutions Per Minute
IPR = Selected Inches Per Revolution
TRW Unit = .001 Minutes

STANDARD TIME/PC.

Machine	1.270 Min.
Handling & Inspection (Per Std. Data)	2.722 "
	3.992 "

AVAILABLE SPEEDS & FEEDS
TABLE L-2

MONARCH 30" x 48" LATHE
Speeds –9–12–16–21–27–34–44–56–71–90–118–150–190–241–320–400
Feeds –.0038–.0040–.0045–.0050–.0055–.0060–.0070–.0075–.0077–.0080–.0090
.0100–.0110–.0130–.0140–.0150–.0155–.0160–.0180–.0200–.0220–.0260
.0280–.0300–.031–.033–.036–.040–.045–.052–.056–.060–.063–.066–.072
.081–.091–.104–.112–.120–.126–.132–.145–.162–.182–.208–.224–.240

SIDNEY 30" x 48" LATHE
Speeds –24–30–36–46–58–74–92–118–146–190–226–292–374–468–556–720
Feeds –.0028–.0030–.0033–.0036–.0041–.0043–.0047–.0048–.0050–.0054–.0057
.0059–.0065–.0072–.0081–.0087–.0095–.0096–.0100–.0108–.011–.012–.013
.015–.016–.017–.018–.019–.020–.022–.023–.024–.026–.029–.033–.035
.037–.039–.040–.043–.045–.047–.052–.058–.065–.069–.075–.077–.080
.087–.090–.095–.104–.116–.130–.139–.149–.155–.160–.174

lated to the figures in Table I, for various operations that can be performed on each machine tool. In practice, the user of the tables gets a basic feed and a basic speed from Table I, multiplies these by factors for the appropriate machine tool, and gets a recommended speed and feed for the operation (drilling, reaming, facing, and so forth).

In general, the engineer follows this procedure when he derives a formula:

1. He selects a worksheet form designed for the machine operation on which the standard will be set.

2. From Table I, he picks out a basic feed and speed, for the material being machined and the cutting-tool material.

3. He goes to tables developed for the machine tool that will do the cutting and picks out factors that apply to the type of operation and the diameter of the workpiece.

4. He multiplies (2) by (3) to get a recommended feed and speed for the operation.

5. Now he selects, from a capability list of equipment specified for the operation, the available speed and feed that are closest to those recommended in (4). These will be used for the machining operation.

6. To get the time for the operation, he converts the selected feed and speed into time units. At Tapco, these are called TRW units: one TRW equals 0.001 minute at optimum or high-task performance. In this process he also adds extra allowances for such machining characteristics as pretravel, overtravel, and drill-point breakthrough.

7. He totals times for each suboperation to get the time standard for the whole operation.

8. To this machining time, he adds times (also in TRW units) for extra-machine work: manual handling, clamping and unclamping, inspection, and so forth. This total gives him the time standard for the entire operation.

Basic concept of procedure

The tables in the manual are designed to handle, with reasonable accuracy—and quickly—a wide variety of product materials, tool materials, and types of cut. Obviously, a very large number of variables affect any cutting operation. But to give careful attention to all possible variables, even if theoretically possible, was impractical here. Such data would have taken years to develop, rather than months. Further, such data would be of an order of detail and accuracy much greater than the specifications of the processes to which they would be applied. For example, the exact grade of tool material for a specific job would have to be known (a fact seldom predetermined in advance in a job shop).

For these reasons, the team intentionally ignored many of the less significant variables in cutting operations; for many other variables, it chose representative or average values rather than exact ones. It was able to make these compromises because of conditions peculiar to the Tapco shops. A mass-production shop, or any job shop with a more limited range of materials, tool materials, and cutting operations should treat the variables more precisely. If it does, it should beat the standards derived from Tapco data, the team points out. In its present form, the Tapco data is a springboard from which these shops can achieve even better results.

To compile the data, the approach was to (1) draw extensively from literally hundreds of published texts, handbooks, and papers; (2) evaluate them according to Tapco's needs; (3) develop theoretical relationships of variables and draw up tentative charts and tables; (4) validate the theoretical values by test; and (5) reduce the proved values to practical form as illustrated in this article. The worksheet and tables shown here were developed for a production job shop. For toolroom use, data was further condensed, to cut application time by 80%.

The basic principles underlying the data are simply these: There is a speed that is best (recommended) for turning each product material, at a specific depth of cut, with high-speed steel, single-point tools. As the tool material changes, this speed is adjusted up or down. Given this speed and a desired tool life, the recommended feed can be computed. For other operations, recommended feeds and speeds will be greater or lesser than those for turning, because the cutting action changes for drills, milling cutters, grinding wheels, and so forth. Further, *within* any one of these operations, recommended feeds and speeds vary as the depth or width of cut changes.

Documenting the effect of these variables on the speeds and feeds developed for turning gives a set of data that will be uniformly exacting, regardless of product material, tool material, and the type and size of cut.

(NOTE: The remainder of this article discusses the way in which the Tapco-Birn team developed the tables for its manual. On p 118-9 appears an actual example of the manual in use. In this example, feeds and speeds (as well as time standards) are developed for a turning operation. Frequent consultation of the tables in the example will help to explain more fully the text that follows.)

Developing basic speeds

In Table I (see p 119) the basic speed, or basic surface feet per minute (bsfpm), is the recommended speed for turning a given material at a ⅛-in. depth of cut with a given tool material.

The Tapco-Birn team developed this basic speed in two steps. First it found the bsfpm for each type of material, machining with high-speed-steel (HSS) single-point tools. Sources consulted were handbooks from metals manufacturers and tests from Tapco's metallurgical laboratory.

Collating these references, the team established basic speeds for all the materials, and their alloys, machined in Tapco shops: carbon steel, aluminum, copper, magnesium, tool steel, cast iron, non-metallic materials. Such benchmark materials as B1112 steel and 2011-T3 aluminum were selected, and all other materials were converted to bsfpm values, according to their machinability ratings.

Second step in establishing basic speeds was to repeat the above procedure, substituting cutting tools other than HSS: carbide, alloy, and carbon. Obviously, the basic speed for machining any material will be different when the cutting tool is other than high-speed steel. Basic-speed values for the other tool materials were derived by multiplying the bsfpm for HSS tools by the following factors:

Tool Material	*Tool Factor*
Carbon tool steels	0.52
Cast alloys	1.50
Sintered or cemented carbides	2.35

(The only exceptions to the above factors are for machining nickel alloys and stainless steel. Here the factors for carbide and alloy tools are 4.2 and 2.68, respectively.)

Developing basic feeds

The basic feed, or basic inches per revolution (bipr) that appears in Table I is the recommended ipr for turning a given product material, with a given tool material, to achieve 120 minutes of tool life.

Most sources agree on the *basic*

speed for machining a given material. But there are many different opinions on the *basic feed*, chiefly because assumptions of tool life are so varied. To derive the basic feeds for Table I, the team constructed a nomograph that is based upon two principal sources:

1. *U S Air Force Machinability Report No. 2*, Curtiss-Wright Corp (Wood-Ridge, NJ, 1951)
2. "Metal Cutting Nomograph," by W W Gilbert and W C Truckenmiller, reprinted in *Metal Processing*, by O W Boston (New York, 1951)

Curtiss-Wright research had established tool life in cutting minutes (when turning B1112 steel) for specific speed-feed combinations. To adapt the nomograph to this data, the team slid Gilbert's tool-life scale to make it coincide wtih the Curtiss-Wright results. Then the material scale of the nomograph was expanded to cover all the types of materials machined in Tapco shops. After tests, the team adopted this nomograph for determining speed-feed combinations in the manual. Further tests substantiated tool-life predictions that were based on the nomograph.

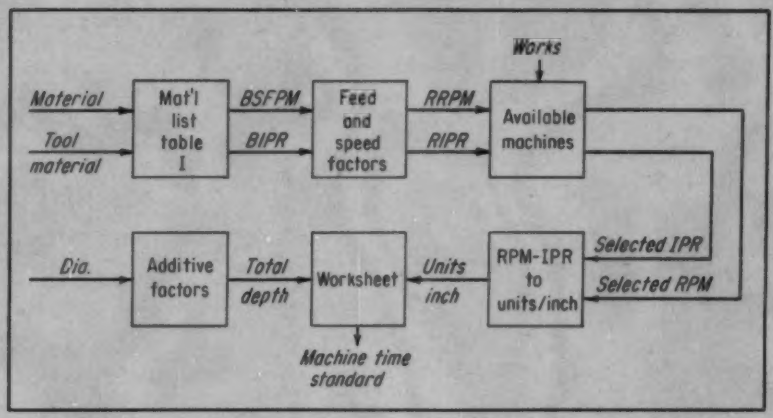
(Exceptions to the nomograph are, once again, stainless steel and nickel alloys. Selected basic feeds for these —0.007 ipr for HSS and alloy tools, and 0.009 ipr for carbide tools—are based on typical feeds for these materials in the Tapco shops.)

Why a 120-minute tool life?

For its speed-feed calculations, the team selected a tool life of 120 minutes cutting time per tool grind, because it is representative of the average Tapco turning job. With this tool life, any speed-feed combination should provide enough cutting time per grind to accommodate a job, and thus eliminate tool changes (except, of course, during setup). Because it is Tapco's practice to grind a tool after each use, the tool life selected had to be consistent with the cutting time of the average job.

With the nomograph, Tapco can establish speed-feed combinations for other tool-life values if necessary. But this change in tool life does not affect the basic speeds and feeds in Table I, for it is accomplished by modifying the factors that apply to the particular machine tool that does an operation.

There is one exception to Tapco's assumption of 120 minutes of tool life for single-pointed tools. For carbide-insert tooling, an economical tool life of 15 minutes was selected.



For drillpress operations formulas are derived by going through the procedure outlined above. Notice that speed factors convert the sfpm figures in Table I directly into recommended ipr. Worksheet for these operations is similar to that for lathe operations

To achieve this tool life, the carbide speed values in Table I are multiplied by 1.7. When speed increases 70%, and the feed remains constant, tool life decreases from 120 to 15 minutes.

Completing Table I

To relate speeds and feeds to the constant tool life of 120 minutes, the team plotted the graph that appears on p 117. Here speed-feed combinations (for turning at ⅛-in. depth of cut, with HSS tools, and with a tool life of 120 minutes) were read from the nomograph, and plotted as circled points through which a constant-tool-life curve was drawn. Then a straight line (to simplify machine-time data) was drawn for each material, originating at zero and intersecting the constant-tool-life curve at the point plotted for the "free-machining" alloy. These lines define speed-feed combinations for turning each material.

With a given speed, one can obtain a basic feed value from the constant-tool-life curve for any material. The product and tool material determine the speed, and with the speed the constant-tool-life curve gives the feed.

In actual practice, there are variations in the range of feeds and speeds for each material. On the reproduced graph (p 117), the scribed lines show the approximate range of speeds and feeds due to differences in machinability, as well as certain operation factors. Because the applicable speed range usually falls to the left of the constant-tool-life curve, feeds tend to be conservative, so that tool life should be expected to exceed 120 minutes in actual practice.

On the graph, the speed-feed line for titanium alloys has been plotted for 10 to 40 minutes of tool life, because the recommended feed at 120 minutes of tool life is too low for efficient cutting action. But commercially pure titanium has the same line as carbon steels. For stainless steel and nickel alloys, speed-feed relationships appear on the graph as a vertical line, because minimum feeds of 0.007 ipr (for HSS and alloy tools) and 0.009 ipr (for carbide tools) were required for good cutting action.

Finding factors

After it had set up Table I, for turning at ⅛-in. depth of cut, the team began developing recommended speeds and feeds for other machining operations (turning at other depths, drilling, milling, and so forth) and for variations within each of these operations. These recommendations, divided by basic feeds and speeds from Table I, give factors for each operation. In practice these factors, applied to values from Table I, will reproduce the recommended feeds and speeds.

In the manual, these speed-feed factors appear in tables—one set for each of the following machine tools: lathes, drillpresses, milling machines, grinding machines, and several special-purpose machines. (Tables on p 118 show the factor tables for lathes.)

General procedure for determining recommended speeds and feeds was as follows: Establish a base point (depth or size of cut) for each operation. Determine the recommended speed for each operation relative to turning. Construct a constant-tool-

life curve for each operation, similar to that for turning in the graph on p 117, but differing in slope because of the different cutting action involved. Read from this curve the recommended feed for the speed established above. Modify both speed and feed values as the depth or size of cut varies. Divide the recommended speed and feed values by those given in Table I for B1112 steel to get the operational factors that appear in the Factor Tables. (This basic approach applies to all types of machine tools; here we shall discuss only the development of factors for lathes.)

Speed-feed factors for lathes

To relate eleven different lathe operations, the team first set up the following base points:

- Basic operation: Turning, ⅛-in. depth of cut
- Basic size of cut: Bore, face—⅛ in.; chamfer, form, knurl—½ in.; cutoff, groove, recess, hollow-mill, trepan—1/16 in.
- Basic material: B1112 steel
- Basic tooling: HSS
- Tool life: 120 minutes

Working with these criteria, the team determined the recommended speed for each operation, at base point, relative to turning. Cut-off, for example, uses the same speed as turning, because the cutting action is similar. The recommended speed for hollow milling is approximately 90% of that of turning, because of the effect of multiple teeth on heat generated in the tool. Similarly, the recommended speeds for other operations relative to turning were established.

Next the team plotted constant-tool-life curves for each operation at base point. These are similar to the carbon-steel line in the graph on p 117 but with varying slopes (according to the nature of each operation). The slope for cut-off is greater than that for turning; this means that for a given speed the feed is reduced, primarily because of the heat generated and the fragile nature of the tool. On the other hand, the slope for hollow milling is less than that for turning; for a given speed the feed is greater, because there are more cutting edges. Similarly, the team plotted curves for all lathe operations.

In each case, the team based its recommended speeds and speed-feed relationships upon (1) perponderance of source agreement on each operation's characteristics relative to turning, and (2) an analysis of the basic differences in removing metals. Incidentally, it is significant that the team gave more attention to the *relative* recommendations of a given source than to the absolute values recommended.

To complete its work on speeds and feeds for other lathe operations, the team followed this principle: Given a product material with a known recommended speed for turning, it is now possible to determine the recommended speeds and feeds for the other lathe operations.

Once it had set up these relationships *between* lathe operations, the team turned to relationships *within* any one lathe operation. Here the speed and feed will vary as the depth (or width) of cut changes. Once again, all operations were related to turning, and a step-by-step procedure, similar to that outlined above, related these speed-feed variations.

Factors for other machines

The example that we have given shows how the Tapco-Birn team developed formulas for lathe operations. In addition, the team established factors for other machines. Basically, the procedure was the same: (1) Select a basic operation on the machine. (2) Relate all possible operations on the machine to the basic operation. (3) Relate the basic operation to the basic feeds and speeds in Table I.

For the following machines, factors were developed in this manner:

- **Drillpresses:** Recommended speeds and feeds, based on a constant tool life of 120 minutes, were developed for a basic operation: drilling a ¼-in. diameter, one diameter deep. Factors relate this basic operation to (1) the basic speeds and feeds (Table I) for turning B1112 steel with HSS tools, and (2) all other drillpress operations. Feed factors are set up to give recommended feeds in ipr; speed factors are provided in a form that gives recommended rpm's instead of sfpm's.
- **Milling Machines:** Basic milling operation is face milling. Tool life selected was 400 minutes, because (1) operations usually last two or three days a job, (2) milling cutters cost more to sharpen than lathe tools, and (3) the cutters are sharpened as required—not necessarily after every job. Relationship of the basic operation to Table I and to other milling operations is established in a manner similar to that for lathes.
- **Grinding Machines:** Recommended speeds and feeds are based on a combination of test results and predicted speeds and feeds. The predicted figures (later verified by tests) were based on assumptions concerning the theoretical relationships of grinding variables and their effect on grinding-wheel life.

Obviously, constant tool life does not enter the picture here. But for grinding operations an analogy to tool life is the "G" ratio, defined as the *amount of stock removed* divided by *the grinding-wheel loss*. The predicted feeds and speeds are based on a "G" ratio in the vicinity of 30 for titanium and 120 for other materials. Basic operation was surface grind.

Tests verify data

The manual is anything but academic. Before stamping its approval on the tables, the team made a series of tests. It confirmed, for example, the nomograph's validity. It checked predicted machinability ratings, and verified the constant-tool-life principle. In sum, these and other tests confirmed that the data in the manual will provide workable speeds and feeds, as well as reliable machine-time figures.

As might be expected, there was some resistance to the manual when it first went into effect. A few shop people felt that some of the prescribed feeds and speeds simply would not work. But they did work when they were applied, much to the surprise of some who preferred a more traditional way of doing things.

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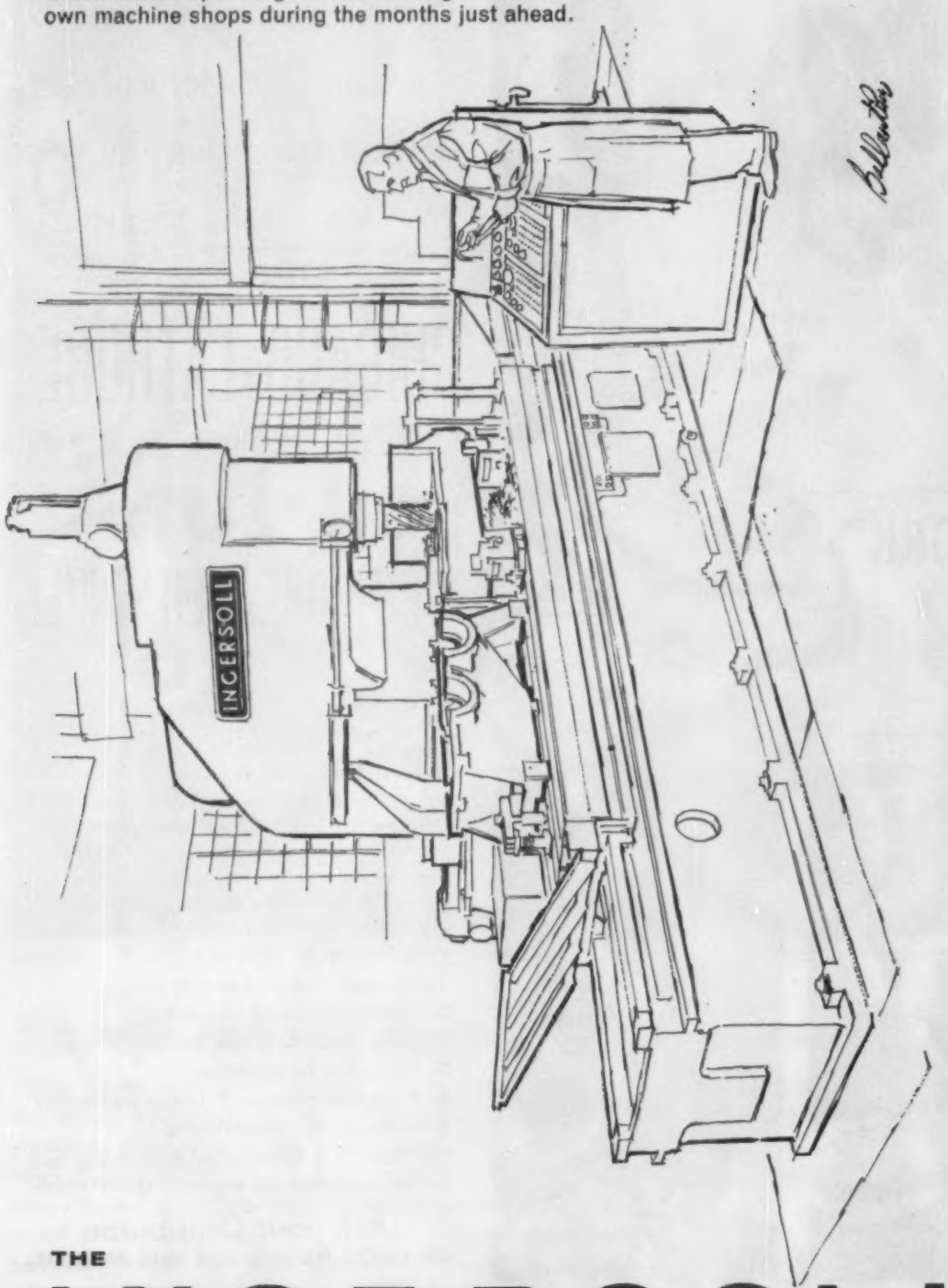
which will be operating on our erecting floors or in our own machine shops during the months just ahead.



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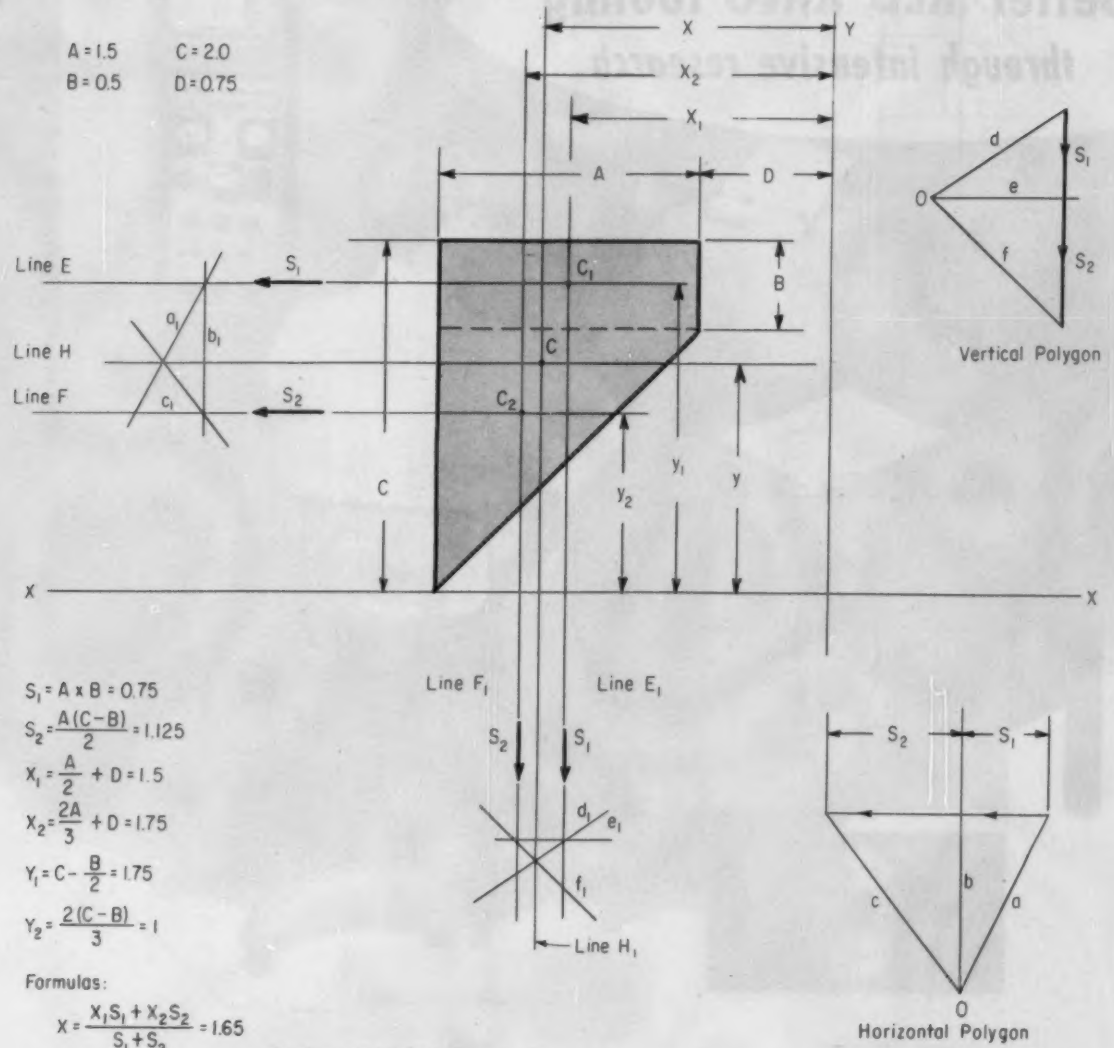
Center of Gravity of Punches – III

By Ferenc Kuchta, mechanical engineer, J Wiss & Sons Co, Newark, NJ

Punch Non-Symmetrical About Vertical Centerline



$S_1 = A \times B = 0.75$

$S_2 = \frac{A(C-B)}{2} = 1.125$

$X_1 = \frac{A}{2} + D = 1.5$

$X_2 = \frac{2A}{3} + D = 1.75$

$Y_1 = C - \frac{B}{2} = 1.75$

$Y_2 = \frac{2(C-B)}{3} = 1$

Formulas:

$$X = \frac{X_1 S_1 + X_2 S_2}{S_1 + S_2} = 1.65$$

$$Y = \frac{Y_1 S_1 + Y_2 S_2}{S_1 + S_2} = 1.3$$

Mathematical Solution:

1. Divide punch outline into geometrical figures; namely, a rectangle and a triangle.
2. Find center of gravity of each figure, C_1 and C_2.
3. Calculate area of each figure, S_1 and S_2.
4. To find coordinates of center of gravity of punch C, set up the formulas for moments of S_1 and S_2 about axes X-X and Y-Y, and solve for X and Y.

Graphical Solution:

1. Follow steps 1, 2 and 3 above.
2. Take any two axes X-X and Y-Y.
3. Draw lines E, F, E_1 and F_1 through centers of gravity C_1 and C_2.
4. To determine the coordinates H and H_1 of the punch center of gravity C, draw two force polygons:

Horizontal Force Polygon—draw S_1 and S_2 in proportion. From their junction point, drop a line b to any convenient pole O. Draw lines a and c. Connect lines E and F with line b_1 and draw a_1 and C_1 parallel to a and C. Line H, where a_1 and c_1 intersect, gives the height of C above axis X-X.

Vertical Force Polygon—Again draw S_1 and S_2 in proportion. Then at lines E_1 and F_1 draw d_1 and f_1 paralled to d and f. Line H_1 is found at the intersection of d_1 and f_1.

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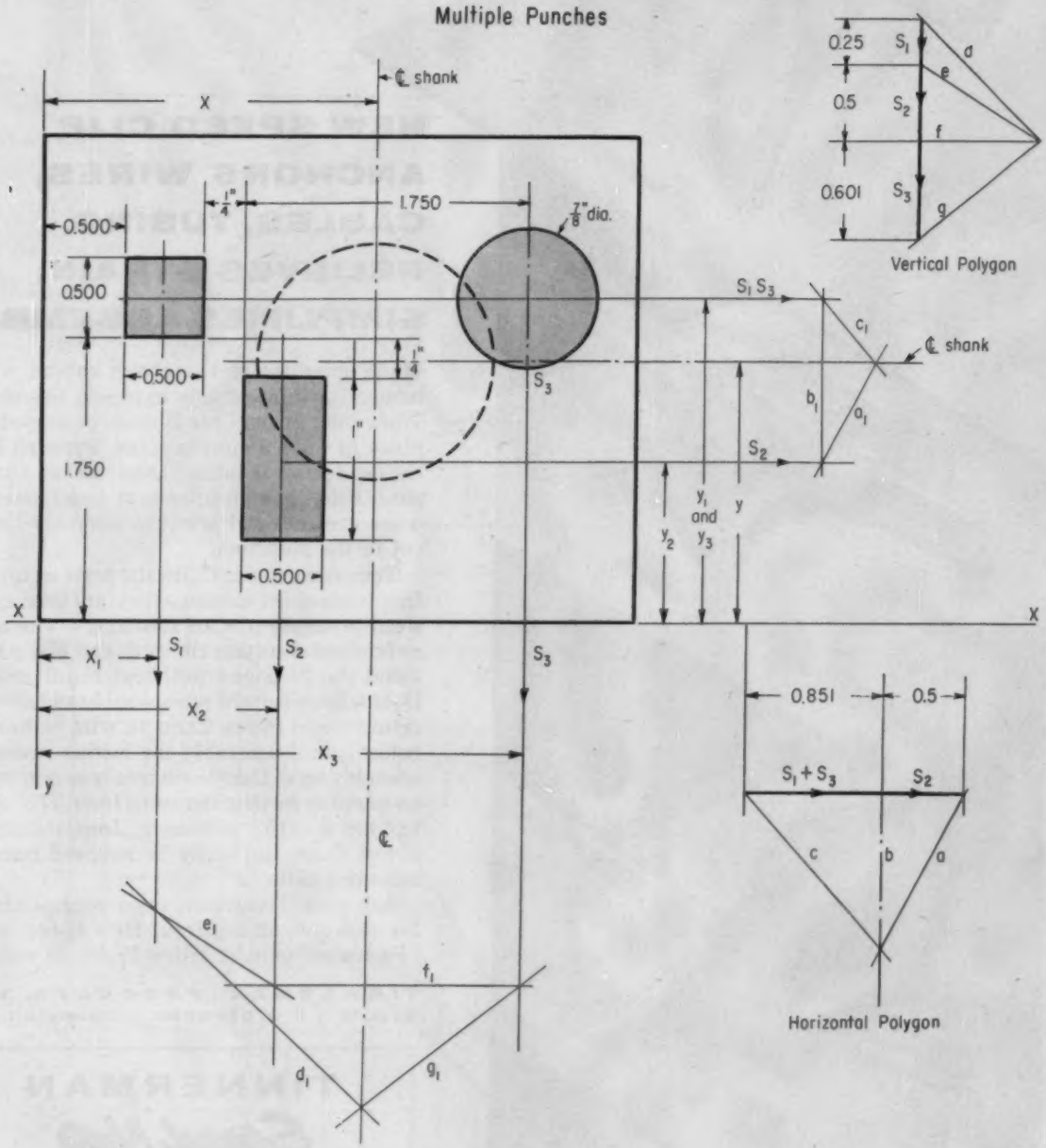
Center of Gravity of Punches – IV

Multiple Punches



Mathematical Solution:

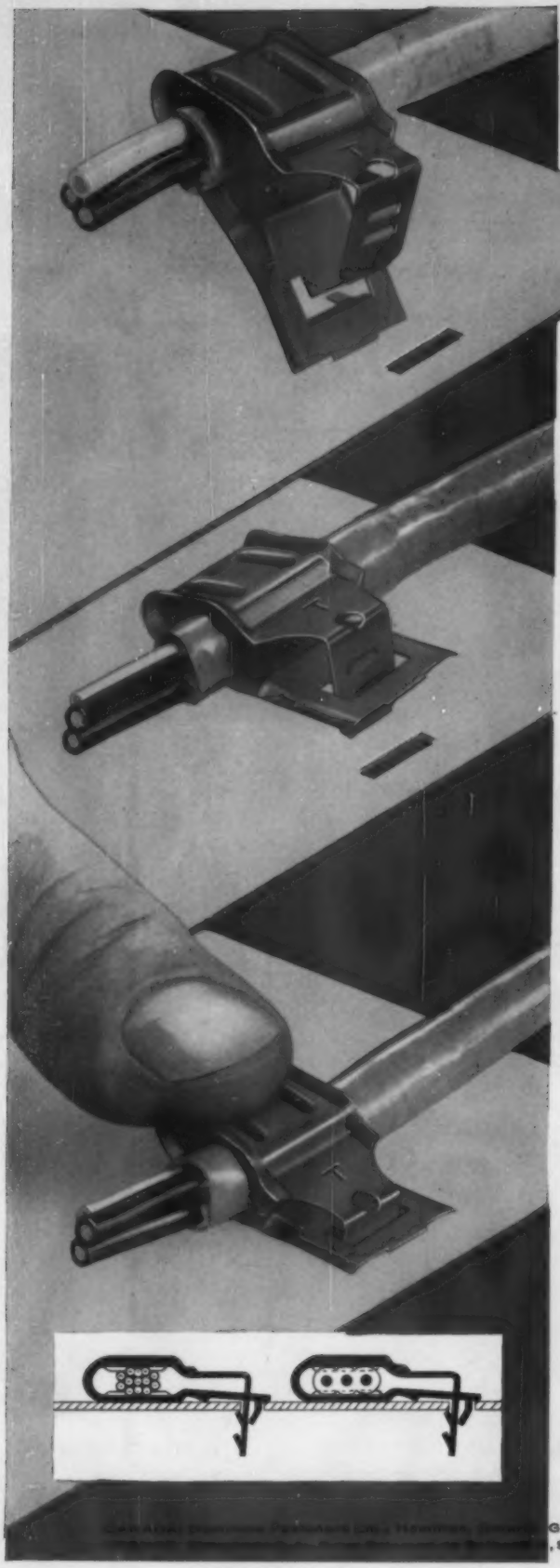
$S_1 = 0.5 \times 0.5 = 0.25$ $\quad X_1 = 0.5 + \frac{0.5}{2} = 0.75$ $\quad y_1 = 1.750 + \frac{0.5}{2} = 2$

$S_2 = 0.5 \times 1.00 = 0.5$ $\quad X_2 = 0.5 + 0.5 + 0.25 + \frac{0.5}{2} = 1.5$ $\quad y_2 = y_1 - \left(\frac{0.5}{2} + 0.25 + 0.5\right) = 1$

$S_3 = \pi R^2 = 0.60$ $\quad X_3 = 0.5 + 0.5 + 0.25 + 1.75 = 3$ $\quad y_3 = 1.750 + \frac{0.5}{2} = 2$

Formulas:

$$X = \frac{X_1 S_1 + X_2 S_2 + X_3 S_3}{S_1 + S_2 + S_3} = 2.028 \qquad y = \frac{y_1 S_1 + y_2 S_2 + y_3 S_3}{S_1 + S_2 + S_3} = 1.630$$



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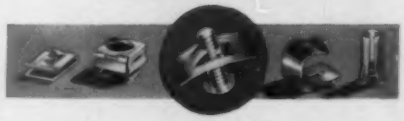

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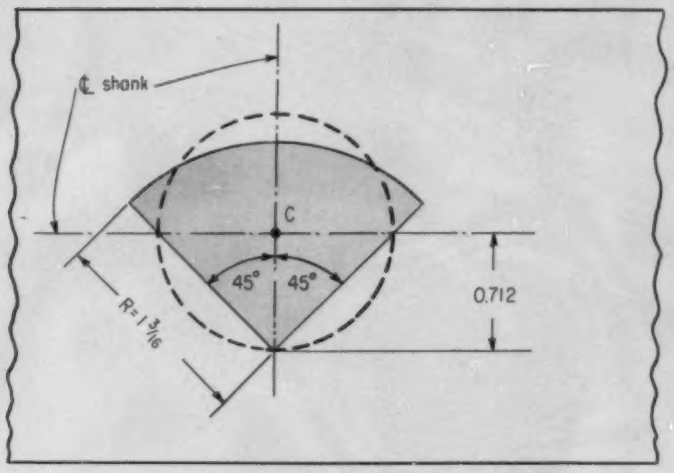
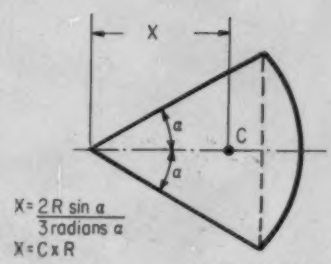
Center of Gravity of Punches – V

Center of Gravity of Sector Punch
(and center of gravity of circular segment)



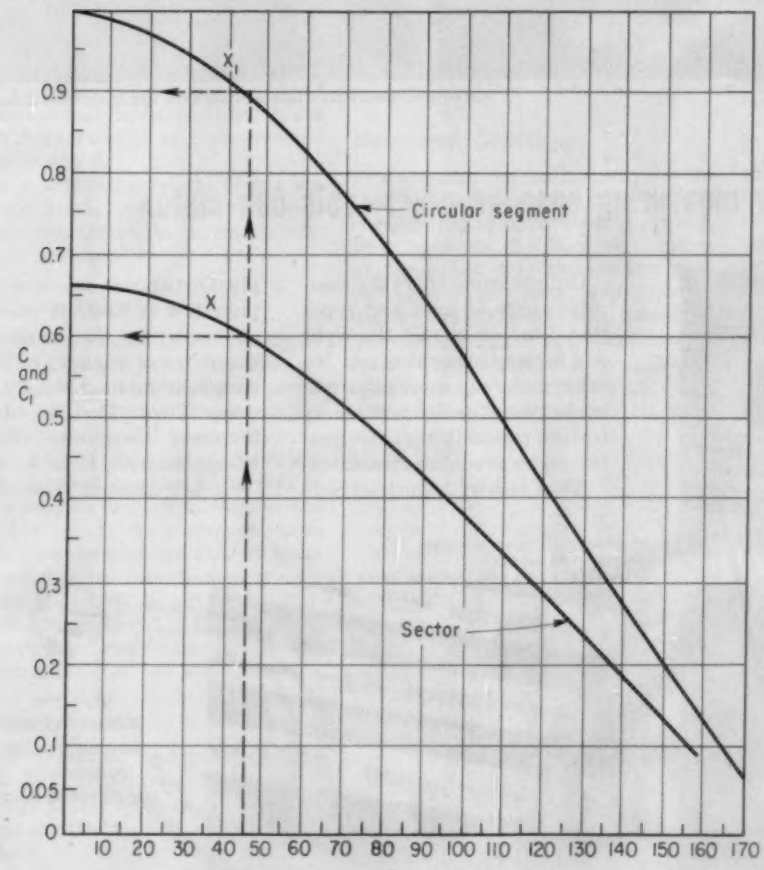
Single Punch

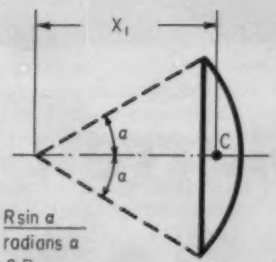


$X = \frac{2R \sin \alpha}{3 \text{ radians } \alpha}$

$X = C \times R$

Sector Punch





$X_1 = \frac{R \sin \alpha}{\text{radians } \alpha}$

$X_1 = C_1 R$

Circular Segment

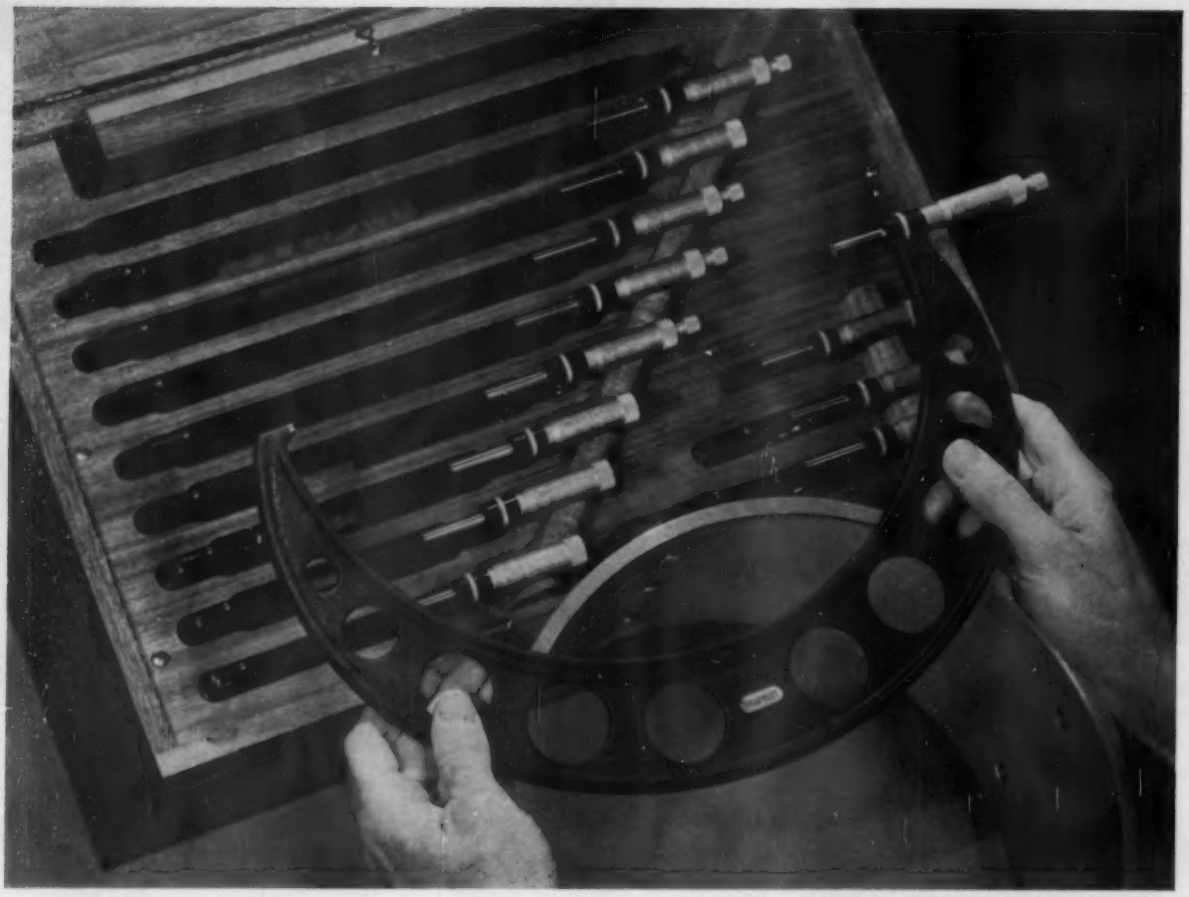
Example:
for sector punch shown,
$\alpha = 45°$, $R = 1.1875$, $C = 0.6$

Then $X = C \times R = 0.6 \times 1.1875 = 0.712$

Note:
Circumference of circle $= 2\pi$ radians
Radians $\alpha = 2\pi / (360° \div 2\alpha)$
for $\alpha = 45°$, radians $\alpha = \frac{6.28}{(360 \div 90)} = \frac{6.28}{8}$

Then $C_1 = \sin \alpha / \text{rad } \alpha = 0.707 \div \frac{6.28}{8} = 0.9$

$X_1 = 0.9 \times 1.1875 = 1.069$



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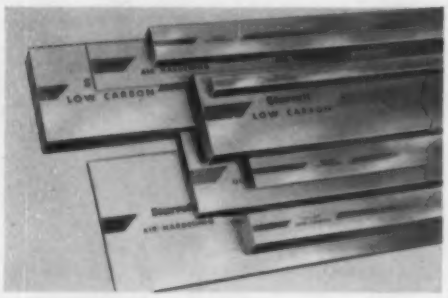

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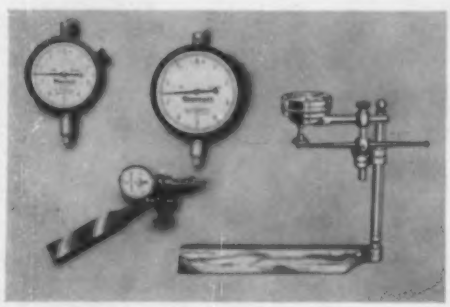

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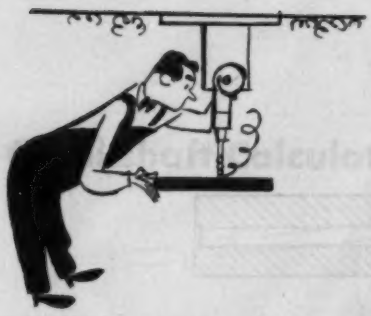
Talking Shop...



Multiple Spindle

A ONE-DAY JOB in a toolroom, boring 22 holes in an aluminum gearbox frame assembly, is now performed in a matter of minutes. It's the old story of putting the job on a multiple-spindle machine. First five large holes are bored, locating from existing dowel holes, with hand clamping in a fixture. Then 17 holes are bored in a multi-spindle setup on an Ex-Cell-O precision boring machine. The close center distances require the use of two "takes." A ten-spindle plate is mounted on one side, a seven-spindle plate on the other and the table indexes with nine of the holes in the first position (four from one side, five from the other) and the remaining eight holes are bored in the second table position. It's a good demonstration of what multiple spindles can do.

An interesting sidelight is that the spindle plates are heated to a constant temperature to maintain consistent accuracy.

Extrusion Boom

A RECENT ANALYSIS of extrusions by the Department of Commerce reminds us that when we did a Special Report on how to make extrusions we predicted a big boom in extrusions. At the time some extruders were unhappy because there was so much surplus capacity. Well in the last five years, the shipments have more than doubled (to 524,000 tons) and the number of extrusion presses tallied rose 69% to 361. The Commerce Dept found 148 extrusion plants, compared with 98 at the earlier date.

Cartoon Thrusts

A BITTER READER has protested the cartoons that spot some of our pages. He says they represent a calculated attack on the dignity and devotion to duty of the men who work in metalworking plants. Since some of our readers run metalworking plants and some of our readers work for the people that run them, we've always considered both groups fair game.

A cartoon (look it up in your dictionary) symbolizes or caricatures subjects or persons in an exaggerated way. Some of our cartoons pick on the foibles of the boss, some pick on the equally vulnerable foibles of the employee, some poke fun at the equipment they both use. We have only two taboos: We don't let our cartoonists make fun of good safety practice and we don't let them pull anything you'd object to your wife or children seeing.

A while back we wrote an item for this page about how we get our best ideas in the shower and you should have seen the caricature of us the cartoonist produced to illustrate *that*.

We publish about one tenth of the cartoons that are offered to us and most of the readers seem to find they liven their studious moments spent with the magazine. What do you think?

Measured Coatings

THE ABRASIVE JET method to measure the abrasion resistance of protective coatings has recently been improved. Developed by the National Bureau of Standards, the method can now be applied to almost any type of coating: organic, ceramic, porcelain, and anodic. Films and tapes can be tested when attached to a rigid substance.

Pressurized gas propels abrasive powder from a vibrating storage chamber through a nozzle onto the test specimen. Most coatings can be tested in seconds with reproducible results. The improvements include devices for setting the nozzle-to-coating distance within 0.002 in.

Trial Paint Run

A WHITE-PAINTED FUSELAGE is going down the final Convair 880 assembly line in San Diego. The plane, No. 32, is a test run on painting before final assembly, rather than after. When it comes off the line, No. 32 will be evaluated to see how well the paint has protected the skin, how well the paint had adhered through mating, and how much retouching will be necessary. So far, the paint coating seems to be giving better skin protection during assembly.

Blickman's Mat

AN UNUSUAL and inexpensive welcome is provided by one company we've encountered. A simple five-page mimeographed bulletin describes what the company makes and how it makes it. The company is S Blickman in Weehawken, NJ, and it makes food service equipment of stainless steel. The booklet is written in simple, layman's terms and made clear by informal little sketches showing the forms of raw material and the different fabricating steps. It cost little more than time and effort by someone and we'll bet it makes the company a lot of friends.

Practical Ideas...

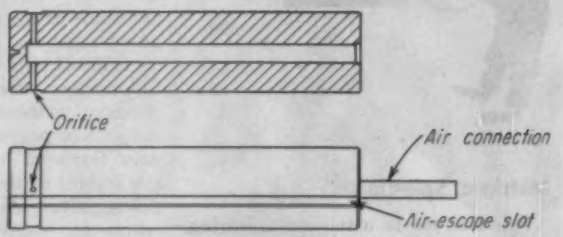
Make Your Own Air-Gage Plugs

Many shops now employ air gages for precision inspection, but usually only on high production runs as the cost of accessory equipment is quite high. $150.00 for a set of air-gage plugs with test rings is nothing unusual. This fact put a damper on our prospect of using this system for inspecting holes on short-run jobs which in our case is usually between 25 and 500 parts.

However, to overcome the financial problem and yet enjoy the benefit of air gaging, I devised my own system of which the air plugs will be discussed here; the rest of the equipment to be described in a subsequent article. This doesn't mean that these air plugs can only be used with the equipment I designed; they will work with every air gage except Federal and Taft-Pierce. For these two makes, the orifices will differ from others, but can be copied if samples are available.

The plugs are made of oil-hardened tool steel turned down on centers to 0.010 in. over required diameters and, at least, ½ in. longer than the holes to be gaged. A 3/16-in. hole is then drilled length-wise into the center, ending ¼ in. short of the far end. About ⅜ in. from the gaging end, drill and ream required diameter hole or holes diametrically through the plug. (See table below for orifice sizes giving 2000 x to 3000 x magnification.) In some cases it may be easier to install a drill bushing having the right size hole than to drill the hole directly into the gage.

To permit easy entry into the part being checked, put a small radius on the gaging end of the plug. Then mill ⅛ in. wide by 1/16 in. deep slots along the plug adjacent to each orifice. These allow waste air and dirt

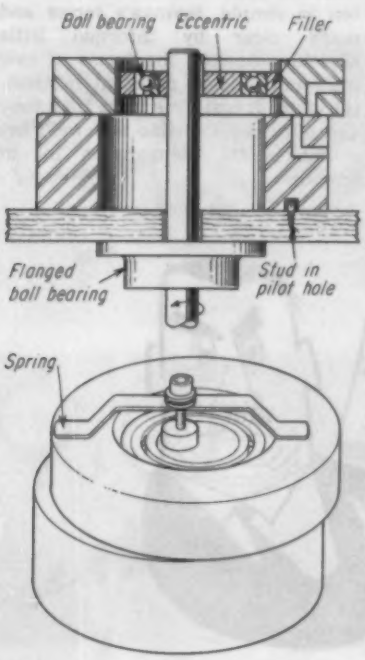


to escape. After the plug has been hardened draw it to Rh 60-62C. Polish out all holes and centers and, if drill bushings are used as orifices, press in bushings and make sure they don't extend into center tube.

After grinding the OD of the plug to 0.001 in. below low tolerance of holes, grind a groove ⅛ in. wide by 0.0007 in. ± 0.0003 in. deep with the orifices centered in it. And finally, to complete the plug, solder a piece of 3/16-in. tubing into the central hole to project ¾ in. The plastic gage hose connects to this tubing.

For average hole checking, a three-orifice plug is most satisfactory, but a two-orifice gage is better for detecting out-of-roundness. Master-setting rings can be an accepted sample part or a drill jig, or die-set bushing honed to exact size. Here are recommended orifice diameters: for a 1-hole gage 0.060 in.; a 2-hole gage 0.042 in., tolerance in both cases ± 0.001 in. For a 3-hole gage 0.034 in. and a 4-hole gage 0.030 in.; tolerance for the last two is ± 0.0005 in.

J Sherman, Brooklyn, NY



Lapping Device Nullifies Human Error

Much of our work involves the construction of distribution valves. Of the various operations necessary, the lapping of the contacting paces is the most critical. This is a job we formerly did by hand, but not only was it tedious, it also required particular skill and care.

To eliminate hand work and insure a better end product, I designed and built the device shown. It consists of a two-level table on which the valve sections are placed for lapping. The lower level carries a speed reducer with a shaft extending through the top. An ideal speed of this shaft is 20 to 25 RPM. A ball bearing mounted in a flange steadies the shaft under the top board. The lower level, being a minor detail, is not shown because of space limits.

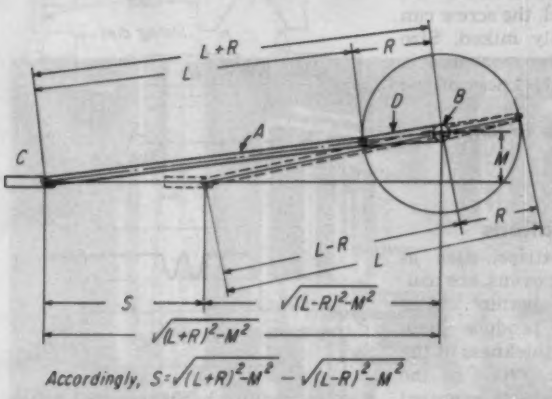
The top of the shaft is fitted with a ball bearing by way of a keyed-on eccentric. Pressed over the outer bearing race is a filler ring whose OD is ⅛ in. less than the valve bore. This permits both valve sections to be slipped in place without disassembly of any kind.

In use, the heavier valve section is placed on the table where it is held concentric by studs engaging pilot holes in the valve. The top face is then charged with lapping compound and the mating half of the valve placed on top. These valves are generally massive enough not to require any additional weight, but should more pressure be necessary, a leaf spring can be spanned across the bore with a screw holding it to the shaft. Under the head of the hold-down screw is a small thrust bearing to eliminate friction. See lower half of sketch.

As the power is turned on, the eccentric cranks the top half in a rotary motion which, at the same time, creates a slow revolving motion in the opposite direction. This produces a criss-cross pattern, spreading the compound evenly for highly-finished contacting surfaces.

Angel A Ayala, Monterrey, N L, Mexico

Crankshaft Calculation Sped by Revised Formula



In our work recently, it became necessary to investigate the motion of the illustrated offset crankshaft. The general expression for slider displacement requires solution by trial and error. This rather long process requires at least six trial substitutions. Since it was necessary to precisely determine the crank throw for a given slide stroke, the trial and error method was not reliable.

To simplify this problem, I have solved the general equation directly for R the crank radius. Assuming we know the remaining unknown quantities, the expression can be solved accurately in one step.

From the geometry of the figure, the general expression for slide motion will be as follows:

$$S = \sqrt{(L+R)^2 - M^2} - \sqrt{(L-R)^2 - M^2}$$

Transposing terms, removing parentheses and squaring the equation we have:

$$S^2 + 2S\sqrt{L^2 - 2RL + R^2 - M^2} + L^2 - 2RL + R^2 - M^2 = L^2 + 2RL + R^2 - M^2$$

or

$$2S\sqrt{L^2 - 2RL + R^2 - M^2} = 4RL - S^2$$

Squaring the equation once more, we find:

$$4S^2L^2 - 8RLS^2 + 4S^2R^2 - 4S^2M^2 = 16R^2L^2 - 8RLS^2 + S^4$$

or

$$R^2(16L^2 - 4S^2) = 4S^2(L^2 - M^2 - S^2/4)$$

Solving for R^2, we have:

$$R^2 = \frac{S^2(L^2 - M^2 - S^2/4)}{4L^2 - S^2}$$

or

$$R^2 = \frac{S^2}{4} \cdot \frac{L^2 - S^2/4 - M^2}{L^2 - S^2/4}$$

If we let $T = L^2 - S^2/4$ and substitute

$$R = \frac{S}{2}\sqrt{\frac{T - M^2}{T}}$$

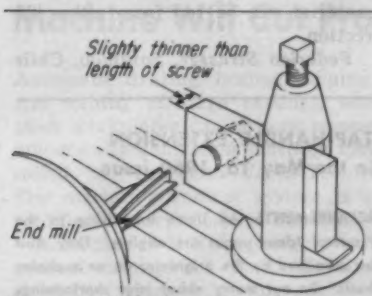
Finally, crank throw $R = \frac{S}{2}\sqrt{1 - \frac{M^2}{T}}$

Example: Let L = 12, M = 1.8, S = 6

Then $T = 144 - 9 = 135$

and $R = \frac{6}{2}\sqrt{1 - \frac{1.8^2}{135}} = 2.964$

R L Waklee, Chicago, Ill



Screws Milled to Length in the Lathe

Though screws can be had in numerous lengths in increments of ¼ in., they are sometimes either too long or too short for a neat and efficient assembly. Hacksaws are most often resorted to for chopping off a thread or two on a too-long screw, but, besides being a taxing job, it does not give you a professional-looking end result.

An easier way, and one that will give you more uniform results, is the method shown. Here, all you need is a block, slightly thinner than the required screw length and tapped to take the screw, and an end mill mounted in the lathe-spindle collet. The block is clamped in the toolpost parallel with the cross slide so the tapped hole is center height.

Next, insert and tighten a screw in the block, feed the screw end into the rotating cutter, and check the length. When the setting for correct length has been found, lock the carriage to duplicate it on screws to follow. If the screws are so long that it would be impractical to increase the thickness of the block, spacers can be used under the screw heads.

Charles R Woglom, Staten Island, NY

Chuck Holds Threading Die in Tailstock Spindle

A small universal lathe chuck, equipped with a taper shank to fit the tailstock, will expedite many small threading jobs in the engine lathe.

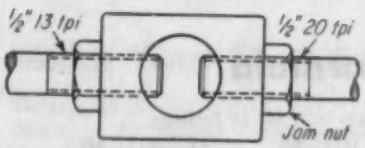
Gripped in the chuck, a standard button die is fed forward onto the work by either of two methods: The

tailstock spindle may be fed by the handwheel, or the tailstock can be sufficiently loosened so it will slide forward as the die screws onto the work. After the thread has been completed, the die is removed by reversing the rotation of the work.

As shown in the illustration, the die and chuck are prevented from slipping by a hose clamp and lever arrangement which counteracts the torque of rotation. The lever rod, which is welded to the hose-clamp screw, bears against the lathe carriage and follows along with the axial feed of the die.

H J Gerber, Stillwater, Okla

Practical Ideas...



Turnbuckle Uses Right-Hand Threads At Both Ends

Ordinarily, turnbuckles are made with left and right hand tapped holes for the adjusting rods. But in an emergency, when none can be bought or when no left-hand tap is available, as was the case in our shop recently, an efficient turnbuckle can be made with right-hand threads of different pitches.

As in the example shown, a block is bored for visual inspection of the rod ends and sometimes for tightening with a bar. The ends of the block are then drilled for tapping; one end for ½-in. 20 threads and the other for ½-in. 13. These sizes can, of course, be of different diameters and thread differentials; ½-in. rods just happened to be the size used in our prototype, hence the suggested ratio. And, by making both rods the same diameter, the rod mountings at the opposite ends are simplified.

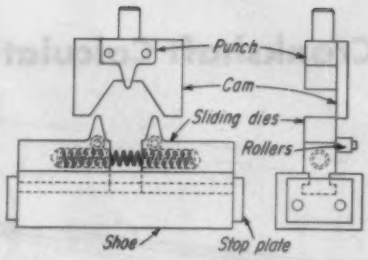
In assembly, both rods are fitted with jam nuts after which the block is run up on the fine thread. The coarse thread is then entered and, as the block is rotated, the rods are drawn toward each other at the rate of 0.027 in. per revolution—the difference between the pitches of the two threads.

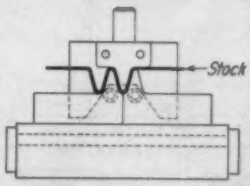
M W Loftus, Chicago, Ill

Old Book Solves Measurement Problem

An old book can make thread measurement an easier chore. When the three wire method is used, it is necessary to somehow support these wires while applying a micrometer. This can be done by inserting them into an old book which has been secured with a gumband. After spacing the wires to the approximate diameter to be measured, the screw can be inserted and easily miked. Size of screw which can be measured is limited only by the thickness of the book.

J. McGinnis, Saddle Brook, NJ





Die Forms Corrugations

Electrical-resistance strips, such as found in heat-treating ovens, are usually corrugated to better utilize available space. To produce them without reducing the thickness of the material at any point, (one of the causes of overheating and eventual burn out) a tool that gathers rather than draws the metal is necessary. The tool shown efficiently fills this requirement.

The die section consists of three main parts; two of them comprising the die between which each convolution is formed, and the third being the shoe in which the first two slide. The sliding dies are kept apart by a spring and are limited in their opening by a stop plate at each end of the shoe. This distance—taken from the center of each half of the forming die—sets the length of the material to be bent in a stroke. Both slides are activated, in unison, by a cam contacting hardened-steel roller mounted on the back of each of the slides.

On the downward travel of the punch, the slides thus begin to close the moment the punch comes in contact with the material. As the travel progresses, the slides continue closing until the material has folded against the inside of the die and around the punch as shown in the lower view. Upon opening, the tool frees the material which is again hooked over one of the sliding dies. Since both die halves are alike, the material can be fed from either direction.

Federico Strasser, Santiago, Chile

Norman Traban Holyoke, Mass Won $25 for his idea:

TAP-HANDLE EXTENSION in the May 16, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

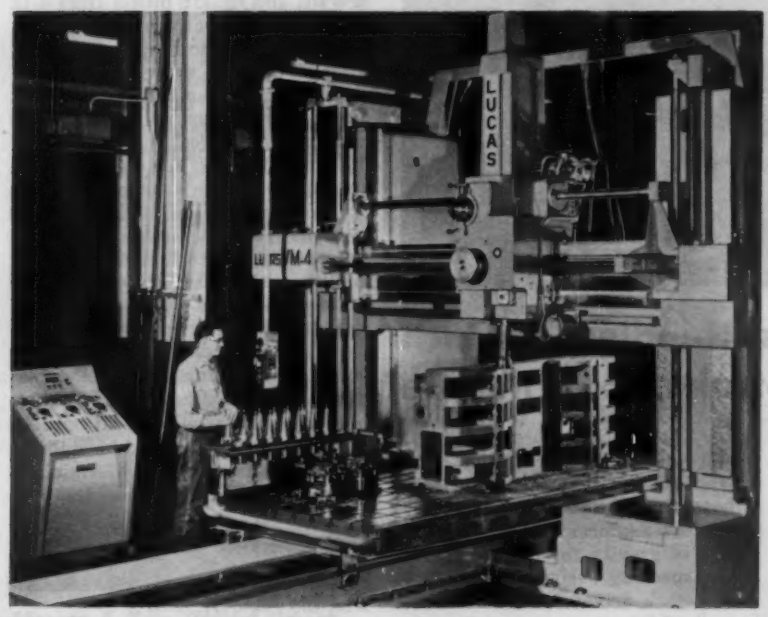
REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc, and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

New Shop Equipment

Materials and Parts



Automatic tool changing, of up to 84 tools, is possible with a "pigeonhole" magazine. The tape signals the table, spindle head, and spindle to coordinate over required tool and then stops spindle rotation—always at the same point—so that drive keys in the spindle line up with keyways in toolholders.

Vertical Boring, Milling, and Drilling Machine Will Cut Production Time 88%

Automatic drilling, boring, tapping, and milling of large castings, and other workpieces, can be done by one numerically controlled machine tool called the Precision Versa-Tronic. The machine's control system is a modified General Electric Mark III.

According to H N Stephan, vp and general manager of the Lucas Machine Div, which builds this machine, its range is twice that of present vertical spindle machines, and its flexibility allows it to handle 80% of all job-shop machining operations. Although it has a large capacity—it will take a workpiece 132 in. long, 78 in. wide, 72 in. high—the Versa-Tronic will work to accuracies of ± 0.0002 in., provides 26 changes of spindle speeds from 13 to 1500 rpm, and has 42 feed rates from 0.0001 to 0.698 ipr.

A single 20-hp motor powers all functions including, under numerical control, precision screws for longitudinal table travel, crosswise spindle-head travel, and vertical spindle travel in and out of sleeve. The powered vertical cross-rail travel is not numerically controlled but is positioned with end-measuring rods to dial indicators.

Features of the machine include: automatic selection and changing of up to 84 tools; operation under manual, keyboard, or punched tape control; automatic spindle reversal and retract for tapping; and rapid traverse of 75 ipm on all motions. Because it is controlled numerically, the machine will take the place of three or four single-purpose tools usually found in a machine shop.

All motions may be performed simultaneously or individually, as desired. A special backlash takeup circuit increases accuracy because it allows the final positioning of each motion to be made from the same direction each time. The zero reference point, from which all motions are positioned, can be moved electrically ± 0.200 in. to simplify setting up. Tape input is to 0.0001 in.

Ten common operating sequences, which can be programmed for continuous operation without stopping for further tape reading, include: tapping with spindle reversal and retract; drill bore, fine; drill bore, course; drill bore, dwell at final depth; traverse to feed without stop; standard positioning; coarse positioning, eliminating creep feed; orient spindle for automatic tool pickup; mill; and selective feed rate.

The machine, which was ordered by the Eimco Corp of Salt Lake City for manufacture of tractor side frames and other components, will go into production within a few weeks. Therefore, it will not be seen at the Machine Tool Exposition. However, a detailed movie of its operation will be available through Lucas personnel there.

Eimco has estimated that the numerically controlled functions of the Versa-Tronic will save 88% of the time formerly needed to produce the parts. Further savings will accure from the virtual elimination of tooling, reduced materials handling, avoidance of rejects, and the other benefits of numerical control.

Lucas Machine Div, The New Britain Machine Co, 12302 Kirby Ave, Cleveland 8, Ohio

MORE DATA? Circle 51, inside back cover

V&O Horizontal Press Handles 6 x 4-Inch Materials at 1500 Strokes per Minute

A new horizontal press, coupled with a specially-designed feed, handles light gauge metals and non-metallic materials at speeds in excess of 1500 strokes per minute.

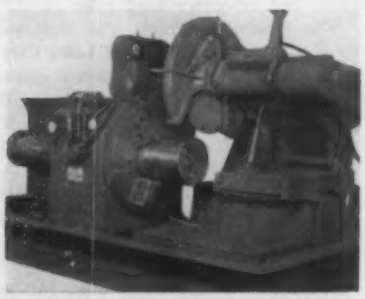
The press design differs from conventional OBI presses in two main points. First, the press is designed on a horizontal plane, rather than a vertical one. Second, the flywheel is centered in the bottom of the press instead of overhanging at the side.

An important advantage of the horizontal press is that work will come straight out toward the operator in a chute from the bed of the press. The main purpose of locating the flywheel in the bottom is to create a balanced design which distributes vibration more evenly. These two features add up to a low center of gravity for more stability.

The specially-designed double roll feed is rack driven from a "walking beam" which, in turn, is driven by an eccentric from top of press shaft. It can handle material six in. wide and up to a four-in. length of feed. Size is 40x25x54 in.

Hudson Div, Emhart Mfg Co, Hudson, N Y

MORE DATA? Circle 52, inside back cover



Rotator Abrasive Saw Cuts Cooler In All Shapes of Hard Alloys

Saw, which rotates material as it is being cut, keeps a cooler surface at point of blade contact, and thereby gives cooler cut and longer blade life. Designed for sawing hard-to-cut alloys in solids, shapes, and tubing form, the saw, according to maker, in the only rotator-type with chuck which will hold both rough forgings and squares, as well as rounds.

In actual plant tests, the saw, designed especially for manufacturers who produce large rounds or squares in various grades of steel, has made cuts up to 16-20 sq ipm on hard alloys. It carries up to a 34-in. dia wet abrasive wheel powered by a 60 hp main drive motor. Sawing assembly is mounted on an adjustable base providing horizontal adjustment of about 18 in., which allows operator to cut slices from end of material. Chuck can handle up to 14-in. maximum outside diameter round, up to 10 ft long.

Completely self-contained and portable, the saw has its own integral tank and re-circulation pump.

Ty-Sa-Man Machine Co, 1001 White Ave, Knoxville, Tenn

MORE DATA? Circle 53, inside back cover

High Abrasion-Resistant Die Steel Comes in Large Size Range

Resistance to edge wear and chipping is provided by Darwin No. 1 FM, a high carbon, high chromium type D2 air-hardening free machining die steel. Stock sizes now available include rounds from ¼-14 in., flats from ¼x½ to 4x6 in., squares from ½-8 in., and square billets from 4-12 in. It is also available in forgings.

The steel's wide range of uses include blanking, drawing, forming, coining, and trimming and piercing dies; shear blades; compacting dies and punches; gages; and thread rolling dies. It is best for dies and tools on production work where hundreds of thousands to millions of parts must be made at minimum cost.

Carefully controlled addition of minute, uniformly dispersed alloy sulfides increases machinability as much as 20% over nonsulfurized D2 steel. Sulfide addition also insures better surface finish and self-lubricating action in dies with no sacrifice in mechanical properties. It hardens at 1800-1850F; air-cooled hardness is Rh63-65 C; steel is nondeforming. It is tougher than other chrome steels of higher carbon content, yet has nonscaling properties and fair resistance to corrosion.

Darwin & Milner, Inc, 2222 Lakeside Ave, Cleveland 14, Ohio

MORE DATA? Circle 54, inside back cover

Powertron Ultrasonic Cleaner Has Self-Tuning Transducer

A new line of ultrasonic cleaning systems features an integral feedback transducer, which automatically adjusts phase and frequency for changing conditions. The autosonic units, which eliminate any need for operator training and constant operator attention, keep the standing wave condition through such variations in conditions as change of liquid level or solvent, heating or cooling, and variations in product or material being cleaned.

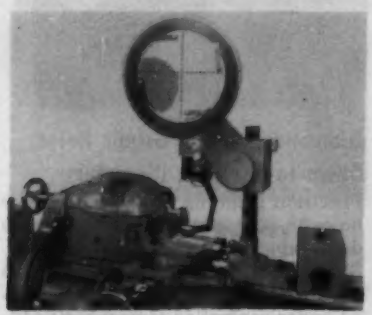
The device prevents equipment damage through operation with an empty tank, which burns out conventional cleaners, because it tunes itself to the lack of activity in the tank. The transducer is bolted to base, thereby improving durability.

Since it needs no operator tuning, the system can be set up in remote locations; thus, the equipment lends itself ideally to automation.

Systems ranging in capacity from 100 to 3000 watts are available in a variety of sizes from ¾-75 gal. In addition, modular construction allows for cleaning systems of virtually unlimited shape and capacity. Prices start at $395.

Powertron Ultrasonics Corp, Garden City, Long Island, NY

MORE DATA? Circle 55, inside back cover



Stocker & Yale Optical Device Mounts on Lathe for Direct View

Model 7M readily attaches to any lathe and therefore allows continuous magnification for checking, direct measurement, and comparison of work in process to transparent overlay charts. With this optical comparator the operator sees his work in magnified form on the screen at the same time the work is being done, not afterward when it might be too late.

The optical system gives a clear, sharp, high contrast image, and no shields or special lighting conditions are necessary. A selection of magnifications from 10-100 power are standard and interchangeable.

Stocker & Yale, Inc, 44 Green St, Marblehead, Mass

MORE DATA? Circle 56, inside back cover

Electronic Device Compensates For Wear on Packer Machines

Adjusta-Matic, a "packaged" electronic device, automatically compensates for buff or wheel wear in high production rate finishing operations. It is included with all new Packer-Matic machines, and can easily be installed on units currently in the field.

Device is completely and automatically controlled through ampere flow by means of special control panel where specified limits of operation are set on simple, easy-to-read dials. Compensating vertical, horizontal, or in-line adjustment to buff or wheel takes place as amperage flow to sensing load detector varies.

Packer Machine Co, 456 Center St, Meriden, Conn

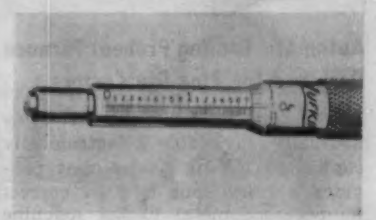
MORE DATA? Circle 57, inside back cover

Size 5 Limit Stop Has 50 oz-in. Torque Rating

Sub-miniature mechanical Model J-10, comprising a half-inch case, is adjustable over the entire range from zero to ten revolutions. Once set, the unit will repeat its limit of travel to within 15 minutes at rated torque. Setting and adjustment may be made at any time. Factory presetting can be obtained without cost. Starting torque is 0.01 oz-in.; temperature operating range is –65 to +125 C. Price is $25.

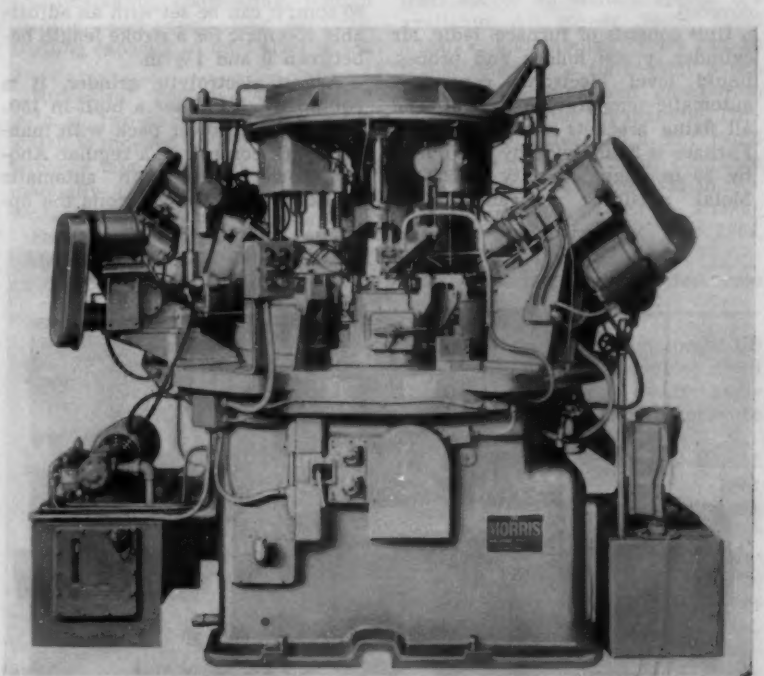
Northfield Precision Instrument Corp, Island Park, LI, NY

MORE DATA? Circle 58, inside back cover



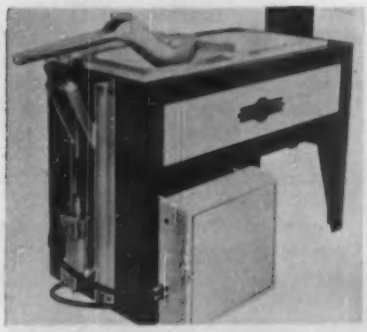
MICROMETER HEAD, No. 012 has 2 in. range and readily attaches to gages and machine tools. With jet black markings each thousandth, its specifications include: range 0-2 in., spindle length at 0 in. is 2 1/16 in., spindle diameter is 0.250 in., clamping surface length is 3/4 in., diameter is 0.3755 in.—*Lufkin Rule Co, Saginaw, Mich*

MORE DATA? Circle 59, inside back cover



VERTICAL CENTER COLUMN high production machine, Model 67S-247, does 23 individual operations—including drilling, spot facing, countersinking, reaming, and tapping—automatically on four-barrel carburetor air horns. Equipped with a six-station automatic index machine produces 375 pieces per hr—*Morris Machine Tool Co, 2011 Eastern Ave, Cincinnati 2, Ohio*

MORE DATA? Circle 60, inside back cover



Automatic Ladling Preheat Furnace Designed for Zinc Die Casters

Unit is reported to be the first commercially available electronically controlled ladling device that provides a continuous flow of correct temperature metal to the machine pot of any medium size zinc die casting machine. Molten metal is kept at a predetermined height in the machine pot by means of an Elcontrol liquid level controller. When level of metal in the machine pot drops to expose the lower stainless steel probe, the ladle device is energized and automatically refills the machine pot with correct temperature metal until the higher probe is covered.

Unit consists of furnace, ladle, air cylinder, probe holder and probes, liquid level electronic controller, automatic temperature control, and all fixing brackets and connections. Furnace is 28 in. wide by 48 in. long by 30 in. high; capacity is 500 lb. Metal partition separator keeps dross and dirt away from ladle bowl.

DCMT Sales Corp, 80 Shore Rd, Port Washington, NY

MORE DATA? Circle 62, inside back cover

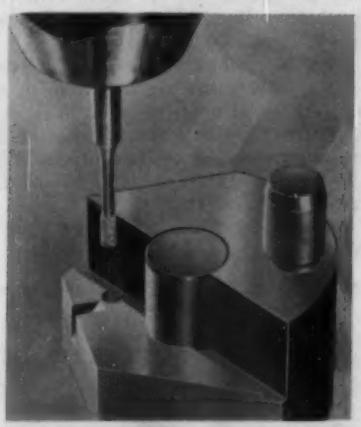
Electrolytic Grinder Designed For Low and Medium Volume Work

Model CME-66 is built and priced for low or medium volume tool grinding. Available with either conventional, manual spark, or automatic spark controls, this machine provides oscillating cup wheel grinding on one end and chip breaker grinding on the other. Chip breaker end is equipped with a VCSE vise for grinding in tools up to 2½ in. wide. The cup wheel oscillates at 60 spm; it can be set with an adjustable eccentric for a stroke length bebetween 0 and 1½ in.

As an electrolytic grinder, it is equipped with either a built-in 150-amp Anocut power pack with manual spark control, or a regular Anocut power pack with automatic spark control. Unit permits the operator to grind faster, rough and finish in one operation, eliminate heat fractures and, according to manufacturer, save from 80% to 90% in diamond wheel consumption.

Hammond Machinery Builders Inc, 1618 Douglas Ave, Kalamazoo, Mich

MORE DATA? Circle 63, inside back cover



Diamond Mandrel Grinds Holes Down to 0.022 in. Diameter

Precision grinding of small diameter holes in all types of material can be done rapidly with diamond mandrel. Shanks are hardened and ground to a very close limit. Diamonds, mounted under controlled atmospheric conditions by an electronic method, have their sharpest edges protruding.

Holes as small as 0.022 in. can be ground accurately and rapidly. In addition to their wide usage on jig grinding equipment, they are used for precision internal grinding, and are ideal for carbide drawing and header dies. Tools are available in a complete range of sizes from 0.018-0.75 in. diameter.

Precision Diamond Tool Co, P O Box 274, Elgin, Ill

MORE DATA? Circle 64, inside back cover

SIX ANODE TERMINALS ARE WELDED and sealed in glass in 80 sec with this two-place high frequency work station. Each place in the station permits attachment of a six-place coil and fixture. The fixture maintains a tolerance of 0.022 on a continuous basis, and locaters are fully adjustable for optimum heating—*Induction Heating Corp, Brooklyn, NY* MORE DATA? Circle 61, inside back cover

GE Introduces Three Types of Brazing Alloys for Stainless

Vacuum melted alloys, under development for over two years, assure inherent high quality by producing a cleaner alloy, essentially free from inclusions, undesirable impurities, oxides, and absorbed gases. They will braze types 321, 347 stainless as well as super alloys such as Rene 41.

One type—the Wide Gap Series—presents a new concept in joining metals, GE's metallurgists report. These alloys will bridge joint clearances up to 1/16 in. with dependable brazed joint. Their use eliminates costly machining operations

necessary to achieve the 0.003-in. clearance which is normal for other types of brazing alloys.

The two other types introduced are general purpose alloys for general high temperature brazing and honeycomb brazing alloys for brazing metal honeycomb assemblies containing thin (0.001-0.005 in.) core material.

Metallurgical Products Department, General Electric Co, Detroit 32, Mich

MORE DATA? Circle 65, inside back cover

Remote Controlled, Battery-Run Magnet Lifts up to 8000 lbs

Lift magnet with maximum lift capacity of 8000 lb is powered by automotive wet cell batteries within magnet case. It can be used anywhere, because the length of haul is not restricted by electrical cords. Remote control is available for ease and safety in handling large parts or for operating magnet from driver's seat of lift truck.

Recessed control panel on magnet contains an operating switch, a dial ammeter which indicates when recharging is necessary, and a polarized receptacle for trickle charging.

Sundstrand-American Broach, Division of Sundstrand Corp, Ann Arbor, Mich

MORE DATA? Circle 66, inside back cover

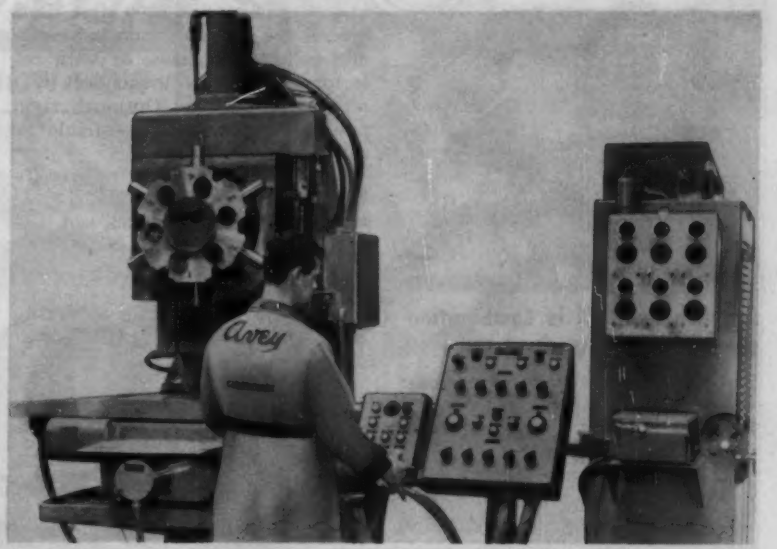
Air Reduction Offers Stainless Wires for Submerged Arc Welding

Chemical composition of wires rigidly conforms to AWS and ASTM standards for corrosion resisting and chromium nickel steels. These standards provide close control of the amount of ferrite in weld deposit.

Automatic stainless steel welding wires are available for use with 308, 309, 310, 347, and 502 stainless, in 25 and 50 lb coils.

Air Reduction Sales Co, 150 E 42nd St, New York 17, N Y

MORE DATA? Circle 67, inside back cover



Avey Hydraulic Production Machine Has Six-Spindle Turret for Drilling, Tapping

With its power-indexed turret, Model 250 Turret-Dex can perform, at one work position, such operations as drilling, tapping, reaming, boring, countersinking, chamfering, bottom drilling, and deep hole drilling. Drilling capacity in mild steel in 1¼ in.

Numerical control is available with a two-axis positioning table which is indexed by standard 8-hole punched tape. Tape may be punched manually as well as with Flexowriter.

Each of the six spindles, any of which may be skip indexed, is of rigid one-piece construction, with taper roller bearings. All have automatic depth control with a micrometer adjustment on the stops.

Feed rate is continuous from 0-120 ipm; six or 12 spindle speeds are available. All speeds, feeds, rapid advance, and tapping cycles can be pre-selected on a convenient panel.

Turret clamping and pushbutton indexing of turret is automatic. Turret spindle travel is 8 in.; rapid traverse rate is 240 ipm; clearance from spindle to table is 8-35 in.

Avey Division, Motch & Merryweather Machinery Co, Box 1264, Cincinnati 1, Ohio

MORE DATA? Circle 68, inside back cover

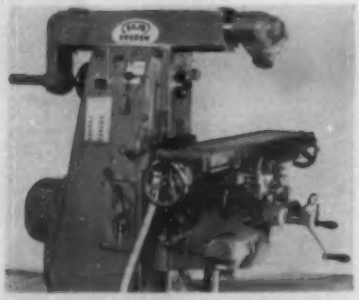
Variable Speed Drive Operates At 2500 to 25,000 rpm

New Varidrive, designated type VEU-GHY, for sustained operation at speeds from 2500 to 25,000 rpm is available on special order with up to 5-hp, drip-proof, totally enclosed, or explosion-proof motors. Unit combines the standard high-speed US electric motor and variable speed transmission with a newly engineered gear increaser to produce this compact model.

Entire unit, which is less than 2 ft high, eliminates external gear boxes, belts, or pulleys. Gears of the Syncrogear gear increaser incorporated in the drive are honed for precise profile and super finish. US Orifeed metered lubrication system is employed to prevent over-lubrication and harmful churning of the lubricant. Several of these units are now being used for aircraft components testing and high-speed emulsification.

US Electrical Motors Inc, Box 8058 Terminal Annex, Los Angeles 54, Calif

MORE DATA? Circle 69, inside back cover



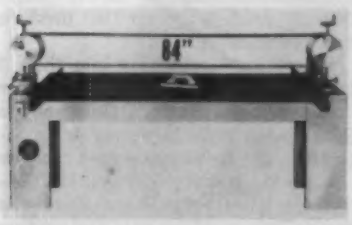
Swedish Duo-Mill is Combination Horizontal and Vertical Miller

Sajo Model is a dual purpose miller which combines in one machine the facilities of both a horizontal and vertical milling machine. It incorporates a special overarm on which is mounted a universal vertical milling head powered by the 3½-hp main drive motor. Compound swivel arrangements of the all-angle vertical head allows milling at any point within a 360° vertical circle. Changeover from vertical to horizontal milling is made in a matter of seconds. Universal head can be quickly swiveled out of the way and the machine operated as a conventional horizontal miller using outboard arbor support mounted on the overarm.

Unit is powered by 3½-hp main drive motor and ¾-hp table feed motor. Manual and power feeds in three directions are available with range of 27½ in. longitudinal, 8¼ in. cross, and 18¼ in. vertical travel. Table working surface is 41⅜ x 9¼ in. Machine is also available equipped for horizontal milling only, with conventional overarm and overarm braces in place of toolmaker's overarm.

Dist by Austin Industrial Corp, PO Box 430, White Plains, NY

MORE DATA? Circle 70, inside back cover

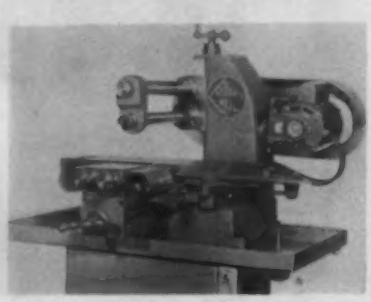


Hand-Stroke Belt Sander-Finisher Has 84 x 28-in Worktable

Unit for finishing ferrous and nonferrous metals, plastics, and wood has a reciprocating worktable with more than double the area of its preceding model. Balanced aluminum drums turn the abrasive belt at speeds of around 4000 sfpm. Both models are available with individual dust-collector systems, or with collector hood ready to connect to a plant-wide system. Optional, rigid, auxiliary worktable is available for small parts finishing.

Boice-Crane Co, 935 Central Ave, Toledo 6, Ohio

MORE DATA? Circle 71, inside back cover



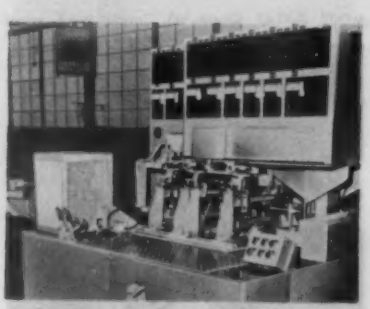
Hydraulic Feed Milling Machine Has Table Speed Up to 600 ipm

Model 624 Hydro-Mill for light-duty production has completely hydraulic feed with infinite table speed both directions from 0 to 600 ipm. Table is 6 x 24 in. and has 10-in. travel and 4½-in. transverse travel. Hydraulic system has only three main parts for easy service and provides changeover on feeds in less than a minute. Feed may be set from right to left and rapid return, or from left to right and rapid return, or from right to left and stop then left to right and stop for use with two fixtures.

Additional specifications include a 2⅞-in. rise and fall of spindle in any one setting with production handle; 6-in. rise and fall of spindle with leadscrew; 4 spindle speeds ranging from 500 to 2050 rpm from ¾-hp motor; 7 in. maximum from table to center of spindle.

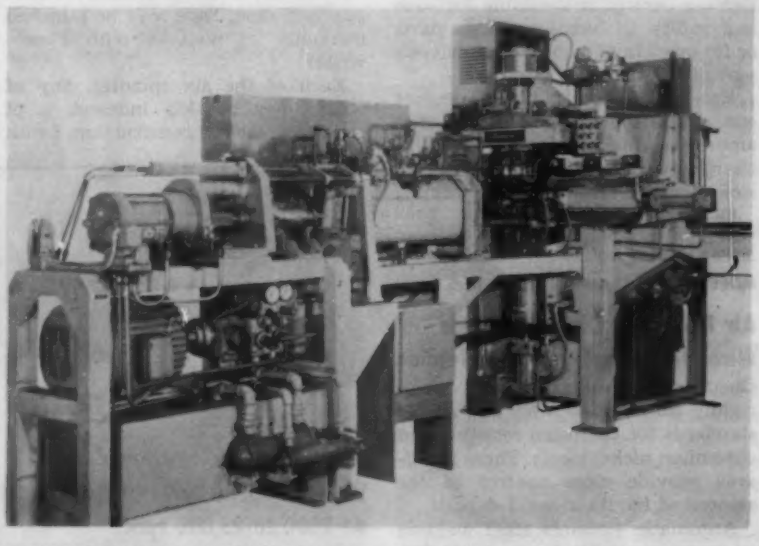
Northern Illinois Machinists, Crystal Lake Rd, McHenry, Ill

MORE DATA? Circle 72, inside back cover



AXLE SHAFT FORGINGS are inspected by machine that checks shaft for run-out and out-of-roundness as well as OD and length. Flange is inspected for thickness (360°) and run-out in reference to shaft. Unit operates at speeds of up to 600 parts per hr. Sizes handled range from 28 to 33 in. in length and 6 to 8 in. in flange dia —*RCA, Industrial and Automation Div, 12605 Arnold Ave, Detroit 39, Mich*

MORE DATA? Circle 73, inside back cover



TRAVELING HEAD SEAM WELDER with automatic feeding, transfer, and expanding units produces motor shells from flat sheets at 500 per hr. Weld power is 400 KVA transformer; weld head seam unit is operated at 4000 lb weld force with 80 psi line pressure from 8-in. dia air cylinder. Cycle time is three seconds —*Federal Machine & Welder Co, Warren, Ohio*

MORE DATA? Circle 74, inside back cover

How Allison Wheels help you get

Quick, Accurate Cuts on Any Material, Any Shape

• Abrasive cutting can give you *cleaner* cuts, *faster*—on almost any material from titanium to fire brick. But only when you use the proper cut-off wheel can you get the best results. That's where your ALLISON-CAMPBELL Field Engineer can help. Show him your cut-off problem, and he can select the ALLISON wheel that will cut your metals and other hard materials at speeds of just a few seconds per square inch—fine finish, without burn and with little or no burr—accuracy within close tolerances.

No matter what cut-off problem you have, chances are the right ALLISON wheel will do the job more quickly, less expensively, and more accurately than any other cut-off method. There's a complete selection of ALLISON wheels for every abrasive cutting application.

• • •

Resinoid bonded wheels are designed specifically for dry abrasive cutting machines. They cut at rates of 3 to 5 seconds per square inch, will cut 2" x 2" hardened steel on a standard chop stroke machine in 16 seconds.

Rubber bonded wheels are used primarily for wet cutting operations to obtain the finest quality cuts on all types of steel, alloys, titanium, glass, and plastics. Rubber bonded wheels are sometimes used for cutting tubing dry with minimum burr.

Masonry cutting blades, including reinforced types, are available for both wet and dry cutting of such materials as fire brick, concrete block, glazed tile, and transite. Use of the proper ALLISON wheel can reduce down-time for furnace repairs by speeding the installation of refractory brick.

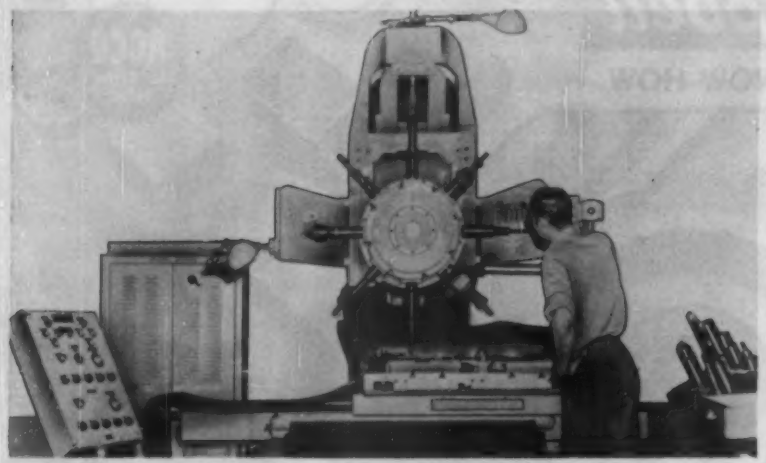
Fiberglass reinforced wheels provide high cutting speeds while giving extra strength for many foundry cutting jobs. They're available in both resinoid and rubber bonded types, help prevent accidents and costly breakage.

GET THE COMPLETE STORY! Write for **Bulletin DH-214** for detailed information on abrasive cutting techniques, and the wide selection of ALLISON wheel specifications. ALLISON wheels are available 3" to 34" diameter, .006" to 3/16" thick. And remember—your ALLISON-CAMPBELL Field Engineer can give you specialized help. His know-how is your assurance of the efficient, accurate, and economical cutting you can expect from modern abrasive cutting techniques.

ACCO **ALLISON** ABRASIVE CUTTING **WHEELS**

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.



RECIPROCATING FEED ARRANGEMENT, available as optional equipment for deep hole drilling on Burgmaster automatic hydraulic turret drilling machines, permits drilling to a certain depth, retracting to top of workpiece, rapid traversing down to previous stopping point of the drill, drilling another increment, retracting to top of work to clear chips, then continuing on down until final depth is reached. At this point, drill is rapid traversed to top of stroke, indexed to next tool, and continues the machining cycle. Arrangement, when applied to tape controlled Burgmasters, is programmed as an auxiliary function on the tape or it can be called for with a cam drum attachment—*Burg Tool Mfg Co, Gardena, Calif*

MORE DATA? Circle 75, inside back cover

Flame Retardant Laminate Cuts Cost of Printed Circuits

New paper-base phenolic laminate, designated Phenolite Grade XXXPC-476, provides flame retardance with excellent cold punching characteristics at nearly half the cost of epoxy-paper laminates. Base stock meets the electrical, physical, and mechanical requirements of NEMA Standards and UL tests for flame resistanee. It is also available in two copper-clad forms. XXXPC-476-1 is a foil copper-clad laminate with standard adhesive bonding made primarily for commerical radio and TV applications. XXXPC-476-2 is a copper-clad laminate designed primarily for electronic computer printed circuits and military applications requiring plating from alkaline solutions.

Material is furnished in two sheet sizes, 39 x 39 in., and 39 x 47 in. Available thicknesses range from 1/32 to ¼ in. Samples, available for evaluation of specific applications, will be forwarded if material thickness and copper thickness are specified—delivery in 2-3 weeks.

National Vulcanized Fibre Co, 1060 Beech St, Wilmington 99, Del

MORE DATA? Circle 76, inside back cover

Coolant Pump Incorporates New Delivery System

PresSure Kool pump utilizes the Moyno principle in the form of a helical screw rotor turning in a stator to insure positive delivery of coolants or cutting oils at any one or more constant pressures. Vibration-free positive displacement delivers clear, non-foaming coolant without constant manual control of coolant flow. Pump drive starts automatically with the machine but can be an integral part of, or separate from, the machine drive. Outlet design makes it possible to operate several delivery lines simultaneously under differing but constant pressures.

Associated Engineers Inc, Products Div, PO Box 1628, Springfield, Mass

MORE DATA? Circle 77, inside back cover

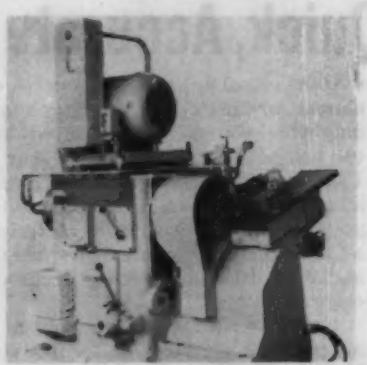
Adhesive's Unlimited Working Life Permits High Volume Bonding

High-strength modified epoxy resin adhesive, Scotch-Weld Brand structural adhesive EC-1595, is a one-component product that contains a latent hardener which eliminates need of accurately weighing and mixing a hardener with the base resin at time of use. In addition, the adhesive has an unlimited working life and will not harden before curing operations are performed. These advantages permit high volume structural bonding operations on large and complex parts.

Material provides metal-to-metal bonds with shear strengths of 2500 psi at 75 F, maintains high strength over a service temperature range of –67 F to +300 F and exceeds requirements of MIL-A-5090B (Class A) and MIL-A-8431 (Type 1) specifications. It has high creep resistance under constant stress, exceptional adhesion to metals and plastics, and excellent resistance to water, 20% salt spray, hydraulic oil, and aromatic fuel. It is self-filleting, which makes it excellent for honeycomb sandwich construction. Only contact pressure is required during curing operations. Optimum cure is 60 minutes at 300 F. Material may be applied by knife coating, spatula, notched trowel, or flowing into place.

Minnesota Mining & Mfg Co, 900 Bush Ave, St Paul 6, Minn

MORE DATA? Circle 78, inside back cover

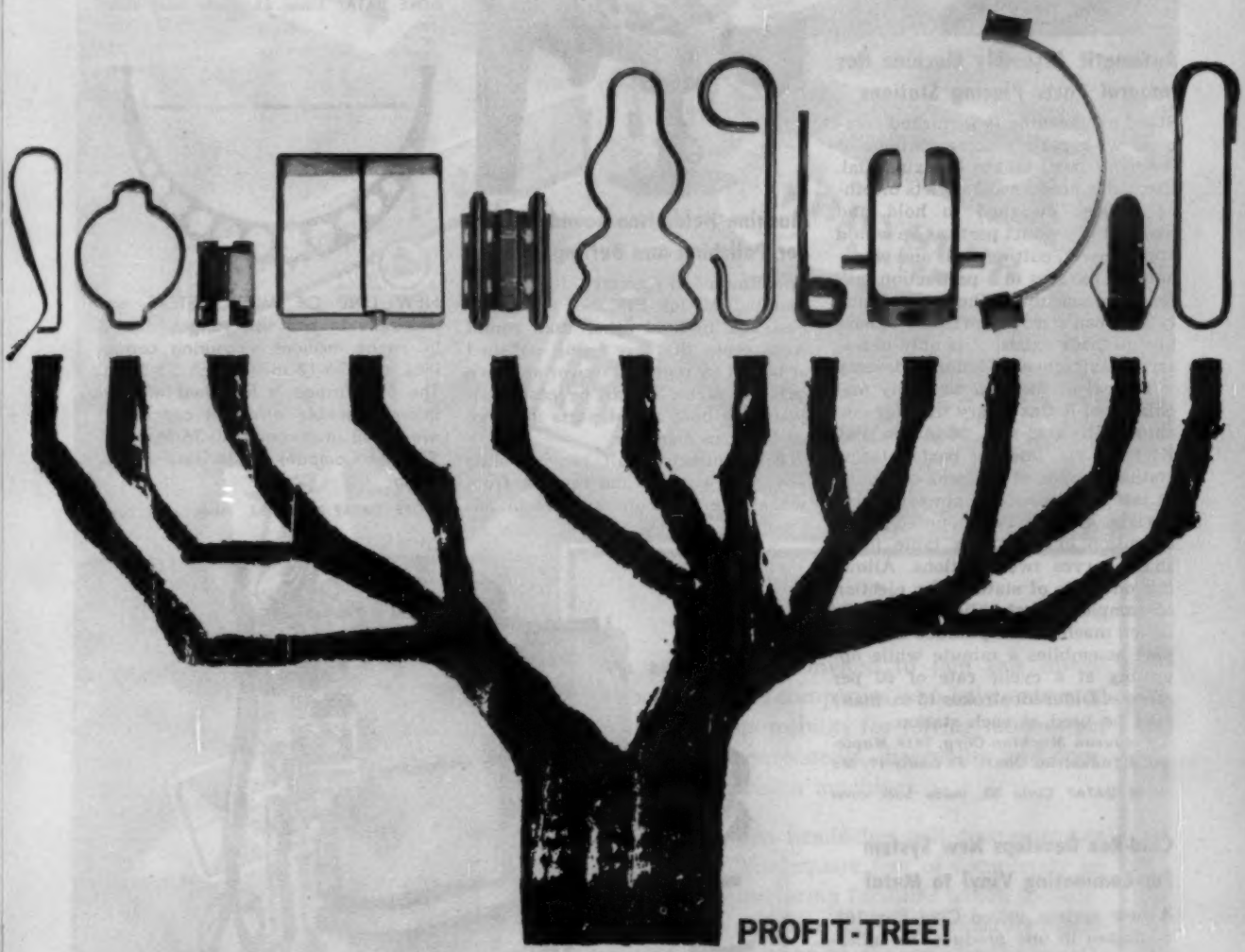


CAM-OPERATED LATHE, Model AR automatic Lo-Swing, takes heavy cuts with coarse feeds of 0.080 ipr for facing 10-in.-dia by 1-in.-thick pipe couplings. Machine is equipped with a back carriage utilizing a back squaring attachment and two carbide cutting tools which are fed to a pre-set position for depth of cut first, then the back squaring attachment moves the tools across face of workpiece—*Seneca Falls Machine Co, Seneca Falls, NY*

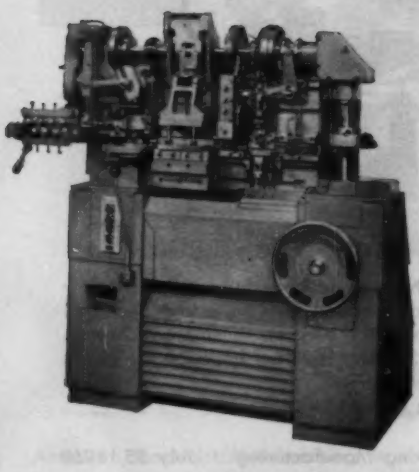
MORE DATA? Circle 79, inside back cover

CIRCLE 241 READER SERVICE CARD ►

THESE PARTS ARE BEING PRODUCED AT SPEEDS OF 90 TO 250 PCS/MIN



PROFIT-TREE!



These are formed parts produced in single automatic operations on the revolutionary new Torrington Vertical 4-Slide.

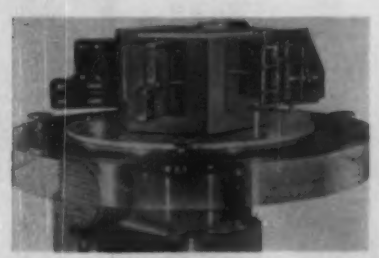
With precision and speed, the Verti-Slide has replaced as many as five and six progressively tooled presses in the production of a complex part. Normal secondary operations such as welding are being done in one continuous automatic operation in excess of 100 pcs/min.

If you make or buy complex wire or strip parts, the Verti-Slide method offers dramatic reductions in production cost. Less parts handling, in process inventory, machine space—all mean greater profits to you.

Write or call for field technical data or a Torrington Sales Engineer.

THE TORRINGTON MANUFACTURING COMPANY

MACHINE DIVISION Torrington, Connecticut



Automatic Assembly Machine Has Integral Parts Placing Stations

Standard machine is furnished complete with parts placing motions at the work nests on the indexing dial. User adds holders and collets or other devices designed to hold and handle his product parts as he would apply special cutting tools and work-holding fixtures to a production mill or screw machine. Where a similarity between sizes of parts and assembly methods exists, it is only necessary to attach new holding devices.

Typical of the new assembly machine tool is this rotary transfer machine with a 12-stop, 36-in.-dia dial. Each of six integral parts placing stations, actuated by cams operating at the dial center and powered from a right angle drive mounted to an extension of the index table input shaft, serves two positions. Allowing one pair of stations for ejection of completed assemblies, the double tooled machine can produce 120 five-part assemblies a minute while operating at a cyclic rate of 60 per minute. Different strokes (3-in. max) may be used at each station.

Ferguson Machine Corp, 7818 Maplewood Industrial Court, St Louis 17, Mo

MORE DATA? Circle 80, inside back cover

Clad-Rex Develops New System For Laminating Vinyl to Metal

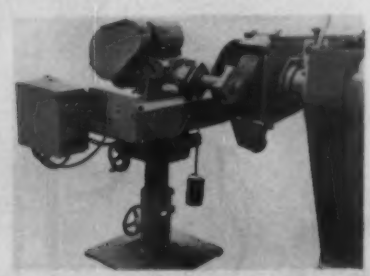
A new system, called Clad-Rex 102, combines in one product the inherent properties of both the metal and vinyl. This bonding method produces a vinyl-metal laminate that can be formed and fabricated much like any unfinished sheet metal because it is, in effect, a single element of material. Forming requires no consideration beyond that normally given to sheet metal.

Clad-Rex 102 can be formed as deep as nine times the depth of draw compared to the corner radius. The usual depth of draw ratio in deep drawing special kill 24 gage steel is approximately 6:1 before metal fracturing is encountered.

The material can be supplied in most decorative designs of vinyl, in outdoor weatherable vinyls, and in stain resistant vinyl.

Clad-Rex Div of Simoniz Co, 2101 Indiana Ave, Chicago 16, Ill

MORE DATA? Circle 81, inside back cover



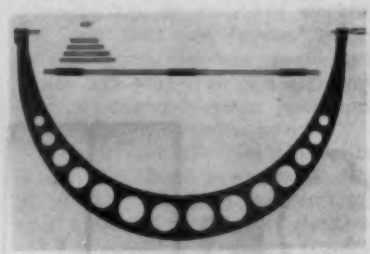
Machine Holds Non-Round Work For Polishing and Buffing Jobs

The Hammond Cammed Junior Automatic, Model EPC, is especially designed to hold other than round workpieces that are being polished or buffed by regular lathe or abrasive belt machines. It can be easily adjusted to hold round parts as large as 14 in. in diameter.

Air controlled ball bearing slide advances work to and retracts from wheel. Vertical column has 8-in. adjustment. Two cross slides (7 in. travel) position work to the wheel. Ball bearing spindle is furnished with speed to suit work. Unit operates on ½-hp, 220/440-v, 3-phase 60-c ac totally enclosed motor.

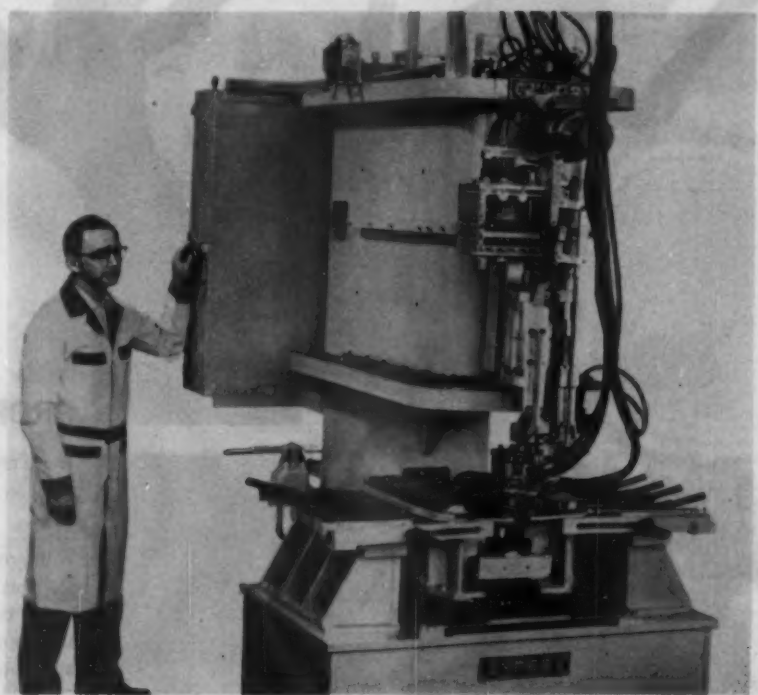
Hammond Machinery Builders Inc, 1600 Douglas Ave, Kalamazoo, Mich

MORE DATA? Circle 82, inside back cover



NEW LINE OF MICROMETERS are available in two size ranges. The 3 in. range includes measuring capacities from 15-18 in. through 33-36 in. The 6 in. range is furnished with six interchangeable anvils; it can measure 12-18 in. through 30-36 in.— *J T Slocomb Company, South Glastonbury, Conn*

MORE DATA? Circle 83, inside back cover



MECHANICAL TRACER WELDING MACHINE automatically follows the irregular weld line contour and welds an unfrimmed U-shaped steel plate to a U-shaped steel rib in production of tractor grill assemblies. The tracer, which produces high quality eye appealing weld seams, welds 20 assemblies per hr—*Expert Welding Machine Co, 17144 Mt Elliot Ave, Detroit 12, Mich*

MORE DATA? Circle 84, inside back cover

An invitation

You are cordially invited to join this distinguished group of companies who have entrusted us with the responsibility for solving subcontract problems on components, assemblies and complete, high-precision machines.

Your subcontract headaches will disappear fast in TMW's million square feet of completely integrated manufacturing facilities which include: 1200 *modern* machine tools, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen with a corps of industry's top designers and engineers.

TMW's facilities and 65 years' experience in precision (tolerance to 10ths) manufacturing is available to you *now*, on a short or long-term basis. For more details, or for new Facilities File Folder, call or write: Textile Machine Works, Contract Division, Reading, Penna.

TEXTILE MACHINE WORKS

CONTRACT DIVISION • Reading, Pennsylvania

Now . . . Look to Lukens For Steel Shape Savings

Face up to the true cost of inventories

$253.50 *in interest alone.* That's what it would have cost our customer to stock the steel for his order of these 5-16" gage tube sheets—had he decided to blank and punch these shapes in his own plant. His plate stock cost would have been $25,350. The interest cost of carrying this for 90 days at—say 4%—is $253.50.

Fortunately, the customer took advantage of Lukens Steel Plate Shapes Service and avoided tying up his capital in plate inventory. *Plus:* he paid no freight charge on the 50% scrap involved . . . instead he was given an allowance for the scrap at high steel mill prices. He avoided the expense of scrap handling. He eliminated shop spoilage.

Moral: Don't tie up capital in steel plate inventories. Contact Lukens for Steel Plate Shapes Service . . . flame cutting, shearing, blanking, pressing, bending, welding—of carbon and alloy plate produced on our own rolling mills. Call or write Fabrication Building, Lukens Steel Company, Coatesville, Pennsylvania. Address Dept. DD-70

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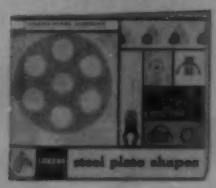


☐ Please send me your free booklet, Lukens Steel Plate Shapes.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

New Pines Bender Handles Large Sizes Of Extra-Heavy Pipe or Thin Wall Tubing

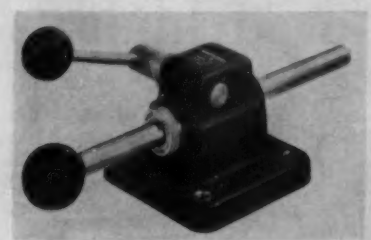
A new model in the line of standard rotary bending machines meets the heavy bending requirements of the automotive, boiler, farm equipment, aircraft, and other industries that form large pipe, tube, channel, angle, and solid bar. The machine is built in two versions.

When set up for bending heavy materials, the Model 6 will handle production bending of extra-heavy steel pipe up to 6 in., channel to 9 in. x 15 lb, square steel bar to 4¼-in., round solid steel bar to 5 in. dia, and steel angles to 8 x 8 x ¾ in. When machine is adapted for handling thin wall tubing as used in the aircraft industry, the Model A-8 is capable of bending steel tube up to 8 in. OD with wall thickness up to 0.250 in.

Both versions of the machine feature smooth hydraulic operation, economy and versatility of tooling, fast change-over in set-up, convenient work height, and dependable bend accuracy within ± ½°. Both are selfcontained and occupy a space of approximately 14 x 32 ft, including arm swing. A 20-hp motor provides power to the hydraulic system. Angles up to 180°, plus sufficient overbend to compensate for springback, are formed in a single cycle. Both machines handle bends up to a 42 in. max centerline radius.

Pines Engineering Co, Inc, 601 Walnut St, Aurora, Ill

MORE DATA? Circle 85, inside back cover



Adjusto-Quick Jig-Lok Eliminates Special Locking Details

Unit which simplifies jig and fixture design incorporates the same automatic pressure control used on L-W Adjusto-Quick vises. Turning of the control automatically adjusts holding pressure from 1 up to 1500 lb; hand pressure locks and securely holds the rigid or non-rigid work in position without distortion. There are no screw threads to wear and no clamping and holding tools are required. End of the hardened and micro-ground locking bar has been left soft one inch from the end for machining to add to fixtures. Two models are offered with base dimensions 4 x 4 in. or 5 x 5 in.

L-W Chuck Co, 25 S St Clair St, Toledo 4, Ohio

MORE DATA? Circle 86, inside back cover

Nironze 635 Offers High Tensile, Yield Strength, Max. Ductility

A nickel-silicon bronze alloy composed of 97.5% copper, 1.9% nickel, and 0.6% silicon, material has equal ductility with 2% silicon bronzes and superior ductility to 3% silicon bronze. At the same time, with proper aging it develops higher tensile strength than 2% silicon bronze. Also, it has a much greater yield than other silicon bronzes or even mild steels, and is superior to any aluminum alloys.

Many applications for this alloy are in the electrical field, where high strength, electrical conductivity, and corrosion resistance are important. Other applications include bolts, studs, U-bolts, cold formed nuts, rails, screws and pipe clamps.

Nitronize is available in round rod and wire only, in lengths from 0.062-1.5 in. and in coils from 0.062 to 0.625 in.

Specifications for drawn and aged Nironze 635 are: 30% electrical conductivity; 1990F melting point; 0.320 lb per cu in. density; 850-900F aging temp; 100,000 psi tensile strength; 85,000 psi yield strength.

Bridgeport Brass Co, Bridgeport 2, Conn

MORE DATA? Circle 87, inside back cover

Multiple Drill Head Designed For Making Miniaturized Parts

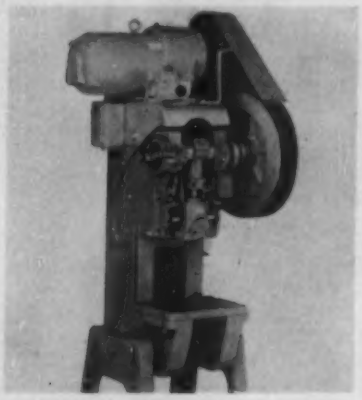
Multiple drill head providing speeds high enough for very small drills on center distances as small as ⅜ in. is especially designed for precision production of miniturized parts. Drill head features speed ranges of 0-8000 rpm, which makes possible the use of extremely small drills.

All spindles are ball-bearing mounted; gears are case-hardened; hole center tolerances are ± 0.001 in. Maximum distance between centers is 3 in.; maximum drill size, #20. Case size is 2, 3, or 4 in. diameter.

Each drill head is especially designed and built to user's production requirments. Price for basic 2-spindle drill head is $150; extra spindles are $35 each.

Metron Instrument Co, 438 Lincoln, Denver 3, Col

MORE DATA? Circle 88, inside back cover



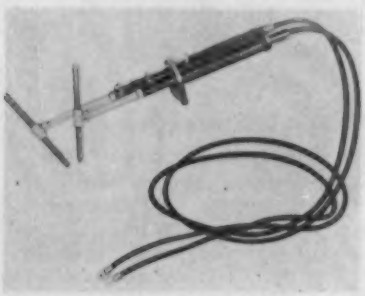
Kenco Presses Deliver Constant Power through 4:1 Speed Range

A new line of variable speed presses provides constant horsepower throughout an extra wide speed range. The user can select a speed range ratio of 4:1 in any spread on 5, 8, 12, 15, 18, or 26-ton standard models.

The heart of the drive is a motor equipped with a gear shift transmission which delivers full rated press tonnage throughout the entire range. An extra large diameter and heavier flywheel, which is driven by Dacron cog-type belts, assures a smooth press power stroke at even slowest speed settings.

Kenco Mfg Co, 5211 Telegraph Rd, Los Angeles 22, Cal

MORE DATA? Circle 89, inside back cover



Arc Torch Introduced By Metal & Thermit

Arc torch which enables existing arc welding equipment to take on jobs formerly done only with gas, creates intense heat electrically and does not exert pressure which could displace molten metal or produce blow holes in thin gage metal. Torch can be used for welding, brazing, general heating or preheating prior to welding, soldering, and hard surfacing.

An ac model is available complete with two 10-ft cables, four ⅜-in. carbons, four ¼-in. carbons, and adaptors for ¼-in. carbons. The dc model is supplied with two 10-ft cables, two ¼-in. carbons, four 5/16-in. carbons, two ½-in. carbons, and adaptors for ¼ and 5/16in. carbons.

Metal & Thermit Corp, Rahway, New Jersey

MORE DATA? Circle 90, inside back cover

Portable Instrument Adaptable to Variety of Tests and Materials

Model M tester can handle metal, plastics, textiles, wire, or springs; simple changes in grips quickly adapt the basic instrument for tests of tensile, compression, transverse, and shear forces. Operation is by means of a calibrated pendulum. All testers are guaranteed accurate within ½ of 1% of indicated reading.

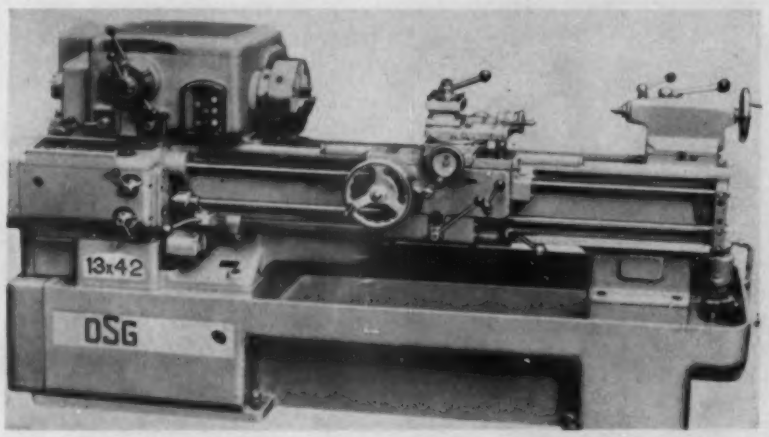
Wide flexibility is provided by the five ranges from 0-10 to 0-300 lb combined on the one 8-in. dial. Calibration is available in a choice of ounces, tenths of pounds, or kilos. Permanent stress-strain curves are also possible with the Dillon rotating drum recording system as an accessory. Model M testers are available with manual handwheel, as shown, or motorized. They can be converted from manual to motorized at any time with a motorization kit.

W C Dillon & Co, 14620 Keswick St, Van Nuys, Calif

MORE DATA? Circle 91, inside back cover

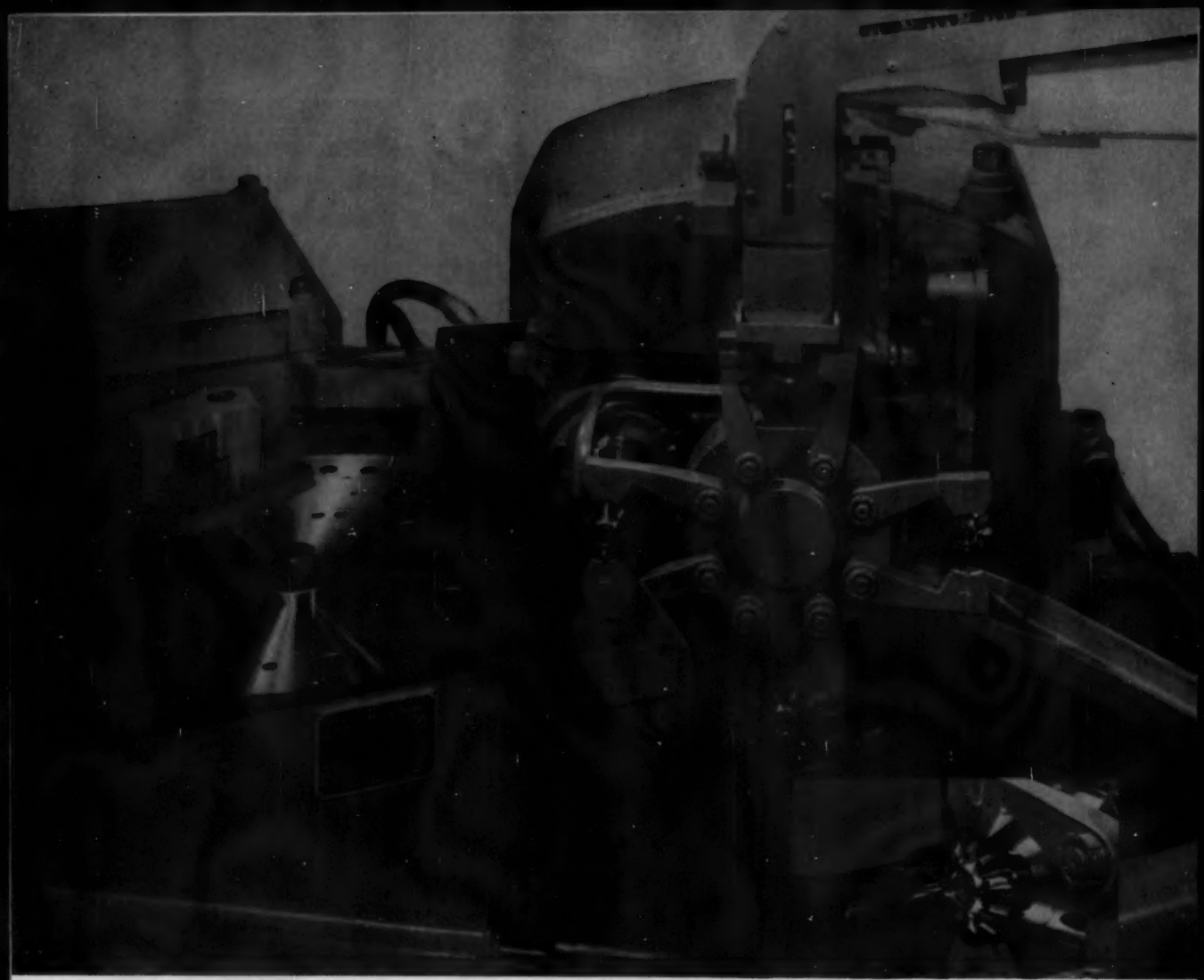
GASEOUS DIFFUSION FURNACE, which accommodates four rectangular refractory tubes 2¼ by 2 in., was designed specifically for semi-conductor industry. Maximum continuous operating temperature is 1300C; uniform zone is 6 in. long at ± 2.5C—*Lindberg Engineering Co, Pilot Plant Equipment Div, 2444 W Hubbard St, Chicago 12*

MORE DATA? Circle 92, inside back cover



13-INCH SWING CENTER LATHE, made in England by Dean, Smith, and Grace, has coarse pitch screwcutting ratio which enables cutting of pitches up to 2 in. Reverse and forward spindle speeds are controlled from operating handle with an automatic brake—*Dist by Fidelity Machine Tool, Inc, 309 Vine St, Camden, N J*

MORE DATA? Circle 93, inside back cover



In Revacycle Method each blade of cutter is longer than its predecessor; there is no depthwise feed of cutter itself. One rotation of the cutter completes each tooth from the solid.

Fastest way yet to cut straight bevel gears

If you're looking for a faster, fully automatic way to cut straight bevel gears and pinions with conjugate surfaces and localized tooth bearings, consider the Gleason No. 109 Straight Bevel Revacycle® Machine.

You rough, semifinish, and finish a gear from the solid blank with a single rotation of the Revacycle cutter.

Now both 21″ and 25″ diameter cutters can be used on the No. 109 Revacycle Machine. The 25″ cutter cuts gears to a maximum depth of 0.600″. The 21″ cutter will cut to a maximum of 0.400″.

A new, completely automatic mechanism loads and unloads each gear. You can feed this loader manually or with a conventional belt conveyer.

The No. 109 Machine handles a wide range of automotive and farm machinery gears: up to 10″ diameter, 5:1 ratio, 1¼″ face width.

Send for our bulletin for information on both the machine and the Revacycle Method.

Storage unit and flight conveyer can be fed manually or with belt conveyer. Even with manual operation, one operator can handle a battery of machines.

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

CIRCLE 246 READER SERVICE CARD

Rodgers Presses

PRECISION HYDRAULIC POWER

FOR METAL FORMING and DRAWING

From Rodgers "Standard" Line Select your "Custom" Model

Easy as A B C:

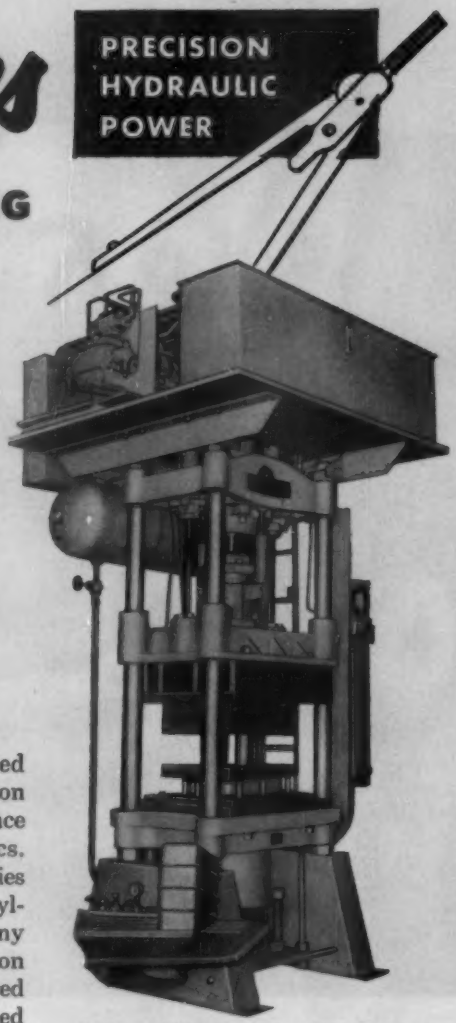
A *Determine Press Tonnage and Style Press You Need*

B *Bed and Frame Size Required... Solid or Open Bolster*

C *Select Pump Unit and Controls To Give Speed You Want*

The New Standard line of Rodgers Platen Presses has been designed to greatly simplify press selection. From the basic press styles, one may be selected and combined with varied pumps and controls, automatic, semi-automatic or pressure sensitive, to give the desired speed and performance. This results in savings of "custom" engineering and costs.

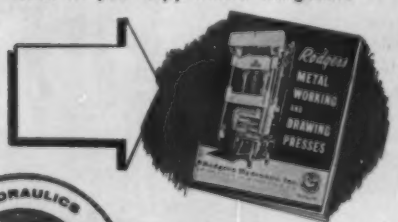
Rodgers Presses are designed and built by an organization with over 32 years' experience in high pressure hydraulics. They are available in capacities from 50 to 400 tons, single cylinder or twin cylinders, in many standard models for production or special uses. Where desired custom models will be designed to suit exacting special requirements.



Rodgers 100 ton 30" x 30" bed size with complete one cycle automatic control for deep drawing.

SEND FOR *NEW* CATALOG 337...

This new Rodgers Catalog has complete specifications, tables and data, making it simple to determine the press for the job. Write for your copy without obligation.



Rodgers twin cylinder, twin die cushion, 200 ton drawing press with 60" x 48" bed; single cycle automatic.

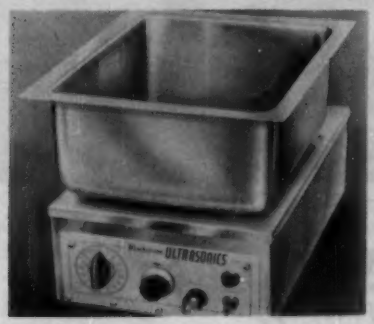
Rodgers 100 ton press, 36" x 36" bed with single lever pressure sensitive manual control.

HYDRAULICS Rodgers KEEP THE WORLD MOVING

RODGERS HYDRAULIC, Inc.

Pioneers in High Pressure Hydraulics Since 1932

7475 WALKER STREET • MINNEAPOLIS 26, MINNESOTA



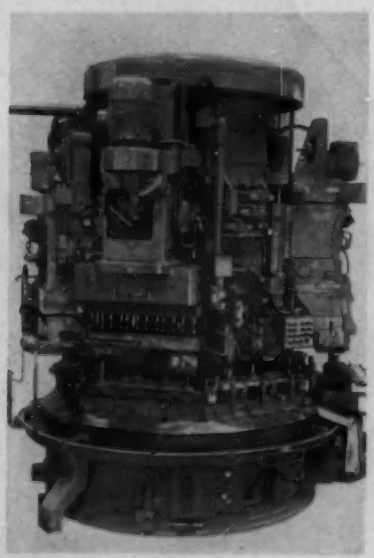
Compact Ultrasonic System Offered For Smaller Volume Cleaning

Model SG-2 consists of an ultrasonic tank and generator in one compact unit. Built-in timer permits selection of desired operating cycle or hold position for continuous operation. Applications include cleaning of instruments, parts, and complete assemblies, and laboratory blending of liquids, dissolving of salts.

Unit is available with either a 1 or 2-gal tank. Operating frequency of 20 kc is used to develop cavitation bubbles of larger physical size that collapse with greater force. Transducer is air cooled and does not overheat low-temperature solutions. Heated solutions to 400 F may also be used without reduced efficiency or damage to the transducer.

Blackstone Corp, Jamestown, NY

MORE DATA? Circle 94, inside back cover



CENTER-COLUMN MACHINE, with 57 spindles, vertically drills and horizontally mills 400 automative connecting rods and 400 rod caps per hour. It measures only 11 ft in diameter—*Foote-Burt Co, Cleveland 8, Ohio*

MORE DATA? Circle 95, inside back cover

Automatic flash removal set-up: When part is indexed to flash removal station, drive head pivots this Osborn Masters Wheel brush forward and downward to remove die-cast flash effectively, uniformly. Rate: 600 pieces per hour.

Flash removal time cut in half

...with Osborn power brushing

600 pieces per hour . . . automatically—that's the *new rate* for removing flash with Osborn power brushes from this die-cast venturi cluster. Former off-hand methods used by this large manufacturer of automotive carburetors produced only 250 to 300 pieces per hour.

Now, flash removal is incorporated into a special 24-station index machine where Osborn power brushes automatically do the job quickly, effectively. Output is consistent, uniform.

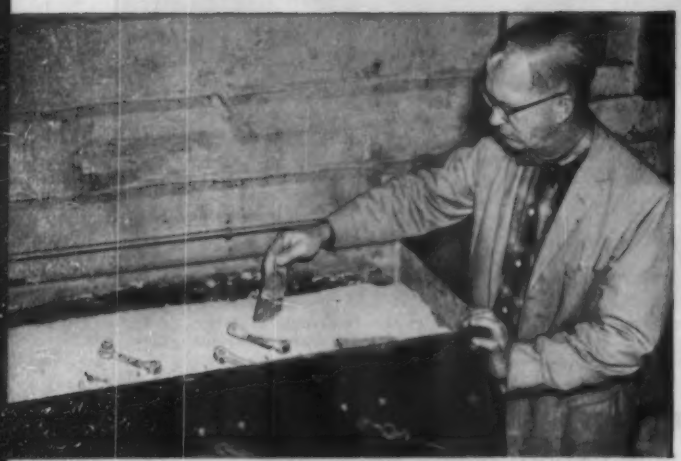
Removing flash from your die-cast parts—especially small, hard-to-handle parts or those with irregular, complex shapes—can be done better, faster and cheaper with Osborn power brushes. In fact, your metal finishing problems of every description—deburring, cleaning, polishing, precision blending—can be solved with advanced Osborn power brushing methods. An **O**sborn **B**rushing **A**nalysis—made in your plant now at no cost or obligation—is the first-step toward improved, less costly production. For details, write or phone *The Osborn Manufacturing Company, Department C-100, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

Osborn Brushes

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

Allis-Chalmers uses **RYKON** *Grease in bearing shield—offers farmers better disc harrow*

can **RYKON** Grease help you improve your product?



Above: Maynard Walberg sweeps sand back over disc harrow bearings on test stand. RYKON Grease is undergoing 2,000-hour test in this simulation of actual farm service conditions.

Below: Allis-Chalmers disc harrow ready for shipment from the plant gets inspection from Standard's Fred Parkinson and Walberg.

Maynard Walberg, Allis-Chalmers project engineer, and Standard Oil lubrication specialist Fred Parkinson, examine disc harrow bearing assembly. Fred is well equipped through training and experience to help industrial customers with lubrication problems. He has been doing this work for 11 years at Standard. He has a degree in chemistry and engineering from Brown University. Plus that, he has completed the Standard Oil Sales Engineering School.

CIRCLE 249 READER SERVICE CARD

Situation: Bearings of a disc harrow in service are always turning in dusty conditions, oftentimes completely covered with soil. Such bearings in the Allis-Chalmers harrow are protected with grease-coated rubber shields. The grease guards against dirt getting past the shield and into the bearing.

What was done: Allis-Chalmers project engineer in the LaCrosse, Wisconsin plant, Maynard Walberg, called Fred Parkinson, Standard Oil lubrication specialist, for a sample of RYKON Grease. In conditions simulating field service, RYKON Grease was tested. Bearings were rotated in the most abrasive dirt available—Mississippi sand with a high quartz fraction.

What happened: Tests were started and run to destruction. Prior to the use of RYKON Grease, bearing failures occurred at 500 hours. On switching to RYKON Grease, these tests were pushed to 2,000 hours. At this point, tests were stopped. Bearings were still in operating condition.

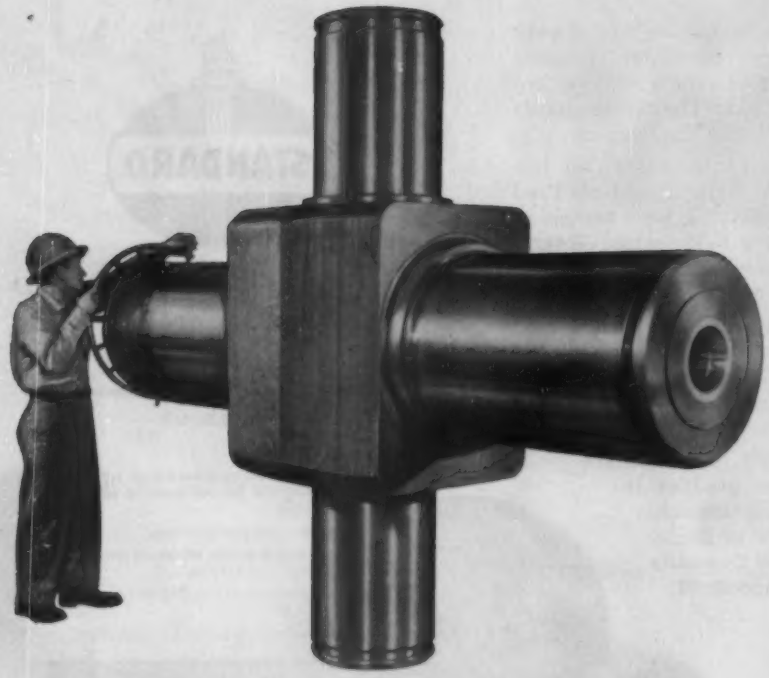
What you can do: Find out how RYKON Grease might help you offer your customers a better product. Inquire of the Standard Oil lubrication specialist nearest you anywhere in the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 So. Michigan Ave., Chicago 80, Ill.**

STANDARD

You expect more from STANDARD and you get it!

Quick facts about RYKON

- Heat stable. At sustained high temperatures RYKON Grease remains soft and grease-like.
- Resistant to water-washing.
- Mechanically stable. Minimum change in consistency in service.
- Resistant to oxidation. Thickener acts as an inhibitor.
- Exceptional rust-preventive properties.



13½ TON EQUALIZING AXLE from BLUEPRINT to FINISHED PART by FINKL

This 27,000 pound steel forging,* made to support a million pound load, was completely manufactured from molten steel to a finished machined part in the Finkl shops.

A 115,000 pound electric furnace steel ingot was cast, forged, hot cut and heat treated, followed by hundreds of hours of rough and finished machining. Then the square section was heated to accept the horizontal part to complete the shrinking operation to make this equalizing axle.

Finkl is well-equipped to engineer and produce a wide range of forged parts . . . our sales engineers will be pleased to talk to you about your forgings, hot work steels and die block needs.

*Replaced a casting

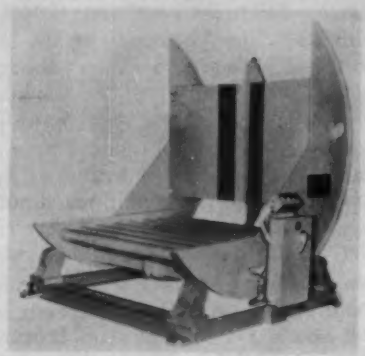
HOT WORK STEELS · DIE BLOCKS · FORGINGS · ELECTRIC FURNACE STEELS

Manufacturers of the
largest forgings in the Middle West

A. Finkl & Sons Co.

2011 SOUTHPORT AVENUE • CHICAGO 14, ILLINOIS

Offices in DETROIT • CLEVELAND • PITTSBURGH • INDIANAPOLIS • HOUSTON
ST. PAUL • COLORADO SPRINGS • SAN FRANCISCO • SEATTLE • BIRMINGHAM • KANSAS CITY
BOSTON • LOS ANGELES Warehouses in CHICAGO • DETROIT • BOSTON • LOS ANGELES



Roth Coil Upender Cuts Costs Of Handling Metal Coiled Strip

Device simplifies handling and upending coiled strip metal stock. The coil is merely slid off truck onto upender which then turns the axis through 90° and places coil in vertical position. This permits transportation of coil by bar- or mandrel-equipped lift truck or similar device. Minimum electric power is required for drive motor since design rotates coil about its center of gravity. Machine is available in many different sizes to suit all coils.

Roth Corp, Box 29, New London, Ohio

MORE DATA? Circle 96, inside back cover

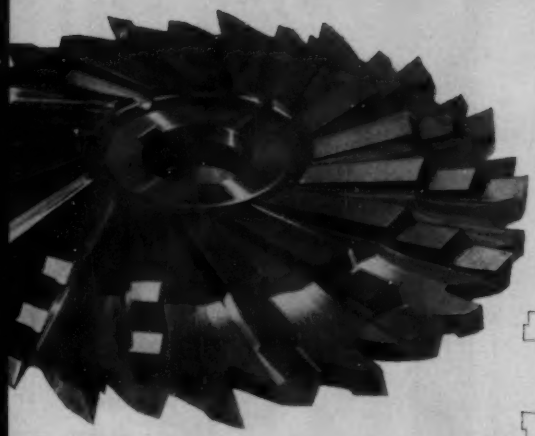
Vertical Pneumatic Grinders Have Either Spindle or Collet Chuck

Series 923 grinders are particularly suited for metal removal in deep cavity molds and other hard-to-get-at places. Weight is 2 lb. The threaded spindle model operates at 18,000 rpm for use with 3-in.-dia depressed-center wheel ⅛, 3/16, or ¼ in. thick with ⅜-in. arbor hole. The collet chuck model is available with speeds of 18,000, 20,000, or 22,000 rpm with ¼, 3/16, or ⅛-in.-collets.

Features include swiveling hose for maneuverability; 3-bladed swastika-type motor; built-in speed regulator; lever throttle with safety lock; and hardened, ground, and honed cylinder.

Thomas C Wilson Inc, 21-11 44th Ave, Long Island City, NY

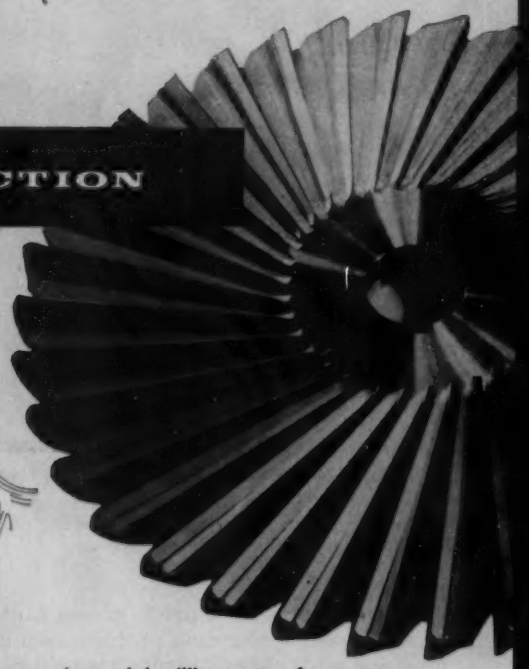
MORE DATA? Circle 97, inside back cover



A special multiple-step milling cutter used by steam turbine manufacturer to cut stepped rotor slots for turbine blades.

This cutter is used by a prominent saw manufacturer to form mill the profile in dado blade sets for the wood working industry.

HOW TO GET THE MOST OUT OF HIGH SPEED PRODUCTION MILLING MACHINES

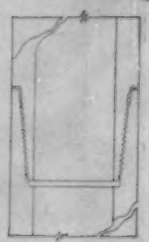


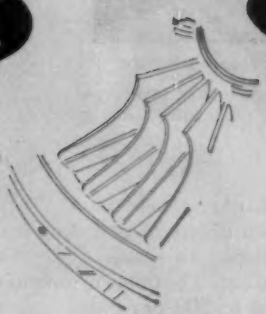
A special milling cutter for sweep milling impellers used in air conditioning and jet engine sections.

This tapered multiple thread mill cuts threads in pipe joints used in oil well drilling operations.

MMT-PE

Visit us at The Machine Tool Exposition Booth #242





Illinite® Special Milling Cutters, like those shown here, speed production and cut costs two ways:

(a) Illinois Tool applied metallurgy assures long, efficient tool life through proper material selection, forging and heat treatment *tailored to your specific application.*

(b) Illinois Tool engineering job-tailors your special milling cutters for maximum efficiency. ITW tool designers often combine several machining operations into a single cutter or gang, with consequent savings of considerable time per piece. Specially designed tools such as these also assure improved accuracy *since accuracy is designed into the tool,* and is not dependent upon several separate operations.

Why not get the most from *your* high speed production machines. Ask your Illinite distributor about job-tailored milling cutters today! Remember, he also carries a complete stock of standard cutters for prompt delivery.

Write today for this helpful new booklet on Metallurgy in Tool Design and Production.

ILLINOIS TOOL WORKS

TOOL & INSTRUMENT DIVISION

2501 N. KEELER AVENUE • CHICAGO 39, ILLINOIS

Your ILLINITE distributor is just a phone call away.

CIRCLE 252 READER SERVICE CARD

do you know how much these abrasive belt problems are costing you ?

GLAZING PROBLEM SOLVED AT TRUE TEMPER CORP.

An *increase* in belt life was realized in the plant of this large shovel manufacturer with the elimination of Glazing in the grinding and polishing of steel shovel sockets.

Decreased abrasive belt life means *higher production costs.* Three outstanding problem conditions in grinding and finishing with abrasive belts are pictured on these pages... Glazing, Stripping and Loading. Their elimination can give you increases in abrasive belt life up to 500 per cent!

A single cause, such as improper product or a combination of causes such as contact wheel, lubricant, pressure or speed can be producing one of these problem conditions in your plant.

Extensive research in CARBORUNDUM'S Coated Abrasives Laboratories has produced a wealth of valuable information on the causes and solutions of abrasive belt problems. CARBORUNDUM'S representatives have now been equipped with this *new* and *exclusive* information to help you improve abrasive belt life in your plant today. Ask your local representative or write to: Canadian Carborundum Co., Ltd., P. O. Box 61, Station "N", Toronto 14, Ontario.

Count on **CARBORUNDUM** *for a full line of high quality abrasive products for all applications.*

CARBORUNDUM

TRADE MARK

CANADIAN CARBORUNDUM COMPANY LTD., *Niagara Falls, Ontario*

CIRCLE 353 READER SERVICE CARD

STRIPPING

A condition in which particles of the grain and bond are actually pulled away exposing the bare backing of the belt.

Eliminate stripping and get increased belt life from 20% to 200%.

LOADING

A condition indicated by the appearance of metal particles packed in between the abrasive grains of the belt coating. In some cases, the abrasive grain is completely covered.

Eliminate loading and get 200% increase in belt life and in extreme cases, up to 500%.

GLAZING

for 60 per cent of [illegible] problems. [illegible] belt to smooth and glossy. This appearance is caused by an [illegible] down tips.

Elimination of this problem can give you increased abrasive belt life up to 150%.

SPEED AND FLEXIBILITY

— with cost-cutting Vertical Shapers

Easily set up and using the simplest tooling, the CHOMIENNE M-5" with its combination of longitudinal, transverse and rotary table movements, angular ram adjustment and ram speeds up to 270 strokes per min. solves production "problems."

Also available —
Vertical Shaper, 12" with 28¼" Rotary Table, 5 HP motor.
Horizontal Shapers, plain and universal 12" to 30" stroke, 2 to 10 HP motors

5" Vertical Shaper
12½" Rotary Table
2 HP motor

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

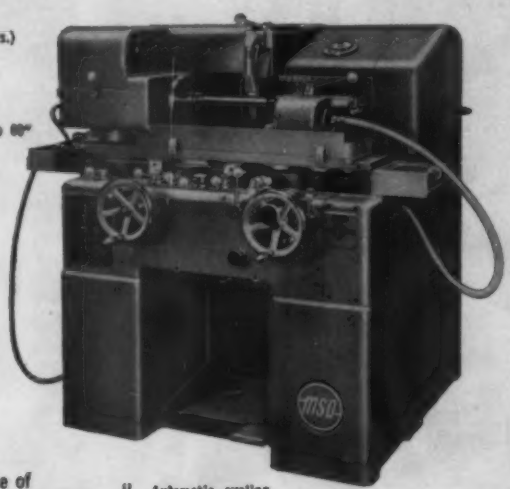
CIRCLE 254 READER SERVICE CARD

MSO Since 1865

FOR MORE PROFITABLE GRINDING

For automatic production in plunge or traverse grinding MSO Hydraulic Grinders offer ease and speed of operation with single lever control, automatic cycling including variable spark-out to fine finish and preset size — against positive stop (repeat accuracy .00004") or by electric gauge.

Model FH-200 (Illus.) Swing 10"
Model FH-100 Swing 7"
Model FH-300 Swing 13¼" Grinding lengths to 60"



MSO offers a complete line of precision grinding machines with features such as:

Automatic cycling
+ Preclmatic sizing
+ Electronic Match Grinding

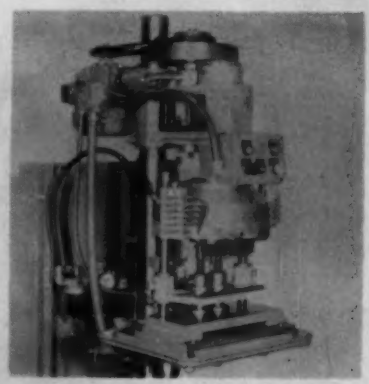
WRITE FOR LITERATURE ASK FOR REFERENCES

When only the best will do, check MSO first

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

NEW SHOP EQUIPMENT



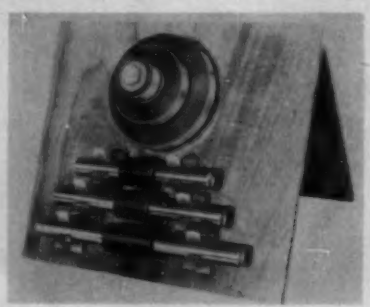
Tapping Head for Terminal Strips Incorporates New Design

Multiple-spindle, simultaneous tapping in short cycle time without a reversing motor has been developed by Zagar. Threading holes with 8/32-in. taps in a 2-sec cycle, 50 holes per pass is possible through gearless design and new drive concepts.

A triple electric clutch and brake in the gearbox permits the motor to drive forward continuously through the flywheel and reverse gear shaft. Necessity and expense of a specially wound reversing motor are eliminated. Leadscrew controls feed in and out of the terminal strip. Compact head is designed so as to be easily installed on standard drill-presses.

Zagar Inc, 23886 Lakeland Blvd, Cleveland 23, Ohio

MORE DATA? Circle 98, inside back cover



English Gage Sets Offered For Checking Micrometers

Gages, made by Harolds Gauges Ltd of Birmingham, England, are available in sets. Micrometer can be quickly checked for accuracy, and the user can readily sense the feel at the correct reading. Sets are made up of spherical rods, ground and lapped for exceptional accuracy, in sizes up to 36 in., and either the rods or cylindrical setting discs are available for sizes 3 in. and under. The smaller rods (up to 8 in. long) are

BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 17

Subject: Surface Treatments for Taps:

The basic ingredient in ground thread taps is —

properly selected and carefully heat treated high speed steel.

Many taps are used every day with superior results if the "basic ingredient" is present. These taps are said to have a "bright finish". There are however, four surface treatments (change in surface characteristics) which can improve the performance of taps when used on some applications . . . but none will compensate for improper selection and treatment of the basic metal. These processes are NITRIDING, STEAM OXIDE, NITRIDING plus STEAM OXIDE and PRECISION CHROME PLATING.

Nitriding

In this process, the taps are immersed in a cyanide salt bath in the range of 1000°F-1050°F for a specified time. This produces a case or surface which is appreciably harder than regularly treated high speed steel. This surface resists abrasion and has good lubricant retaining properties, increasing wear life in abrasive materials and reducing galling or metal pick-up. Nitriding may cause brittleness and is not recommended for small diameter machine screw taps or in tough materials where chipping may be a problem.

Steam Oxide

Bath applies this treatment by use of the Steam Homo process. The taps are heated to the 1000°F-1050°F range in the presence of steam for a specified time. This produces a black oxide surface which has good lubricant retaining properties; reducing galling and metal pick-up. The additional tempering of the process relieves grinding stresses which helps to prevent chipping and improves toughness. It is particularly helpful on some taper pipe tap operations.

Nitriding and Steam Oxide

This treatment is a combination of both processes with nitriding usually applied before steam oxide. Under certain conditions the plus factors of each treatment will be obtained. Quite often if taps with nitriding chip... the condition can be mitigated by applying steam homo.

Precision Chrome Plating (Bath Kromolloy)

This is a special process for accurately depositing hard chrome plate on taps. This surface deposit which resists abrasion, is effective in some grades of stainless steel and certain plastics. It is helpful in preventing galling and pick-up in copper, brass and bronze.

A surface treatment can be beneficial or detrimental depending on the tapping application. Let a Bath threading engineer recommend proper taps for your specific tapping problems. Contact him through your Bath distributor — or write direct.

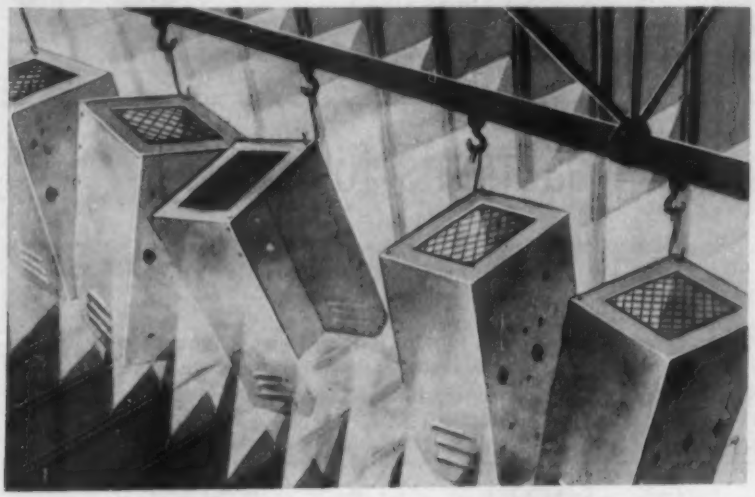
• Cylindrical and Thread Gages • Ground Thread Taps • Internal Micrometers John BATH & Co., Inc.

22 Mann Street, Worcester, Mass.

For tough steel cleaning jobs

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



New acid cleaner Oakite 86 gives fast smut removal . . . good paint grip

Shop smuts on steel parts disappear fast with Oakite 86 in the washing machine. A superior acid detergent, it removes all kinds of soils efficiently—really goes to work on heavily smutted steel. In addition, it forms a conversion coating on steel surfaces to give a good grip on subsequent paint coats . . . helps inhibit corrosion.

Oakite 86 also works well when aluminum, zinc, brass and terneplate pass through the washer.

And it is just the latest in a complete line of Oakite materials for spray washing machines. Others include products for high-pressure spraying, for rapid cleaning, for heavy-duty cleaning, for low-heat cleaning, for conversion coatings. Ask the Oakite man which one will work best with your machines, your metals, your specific jobs. Or, write for FREE bulletin. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 *Est. 1909* SCIENCE

years' leadership in industrial cleaning

NEW SHOP EQUIPMENT

accurate in spherical diameter to ±0.00005 in. Larger sizes are held to proportionately close tolerances, and finer tolerances are available on special order.

Gages are mounted on racks for locating conveniently. Set No. 1 DR 6 (illustrated) has 1, 2, and 3-in. discs and 4, 5, and 6-in. rods. Price is $105. Other sets are available from $70.

Dist by W G Haddrell, 233 Essex St, PO Box 457, Beverly, Mass

MORE DATA? Circle 99, inside back cover

Tin coated stainless steel wire, which is used for banding electric motor armatures, assures a problem-free soldering operation because of the uniformity of the coating. Now in full scale production, the wire can be supplied in any diameter from 0.031-0.105 in. and is packaged on 75 and 100 lb reels — *Riverside-Alloy Metal Div, H K Porter Co, Inc, Riverside, N J*

MORE DATA? Circle 100, inside back cover

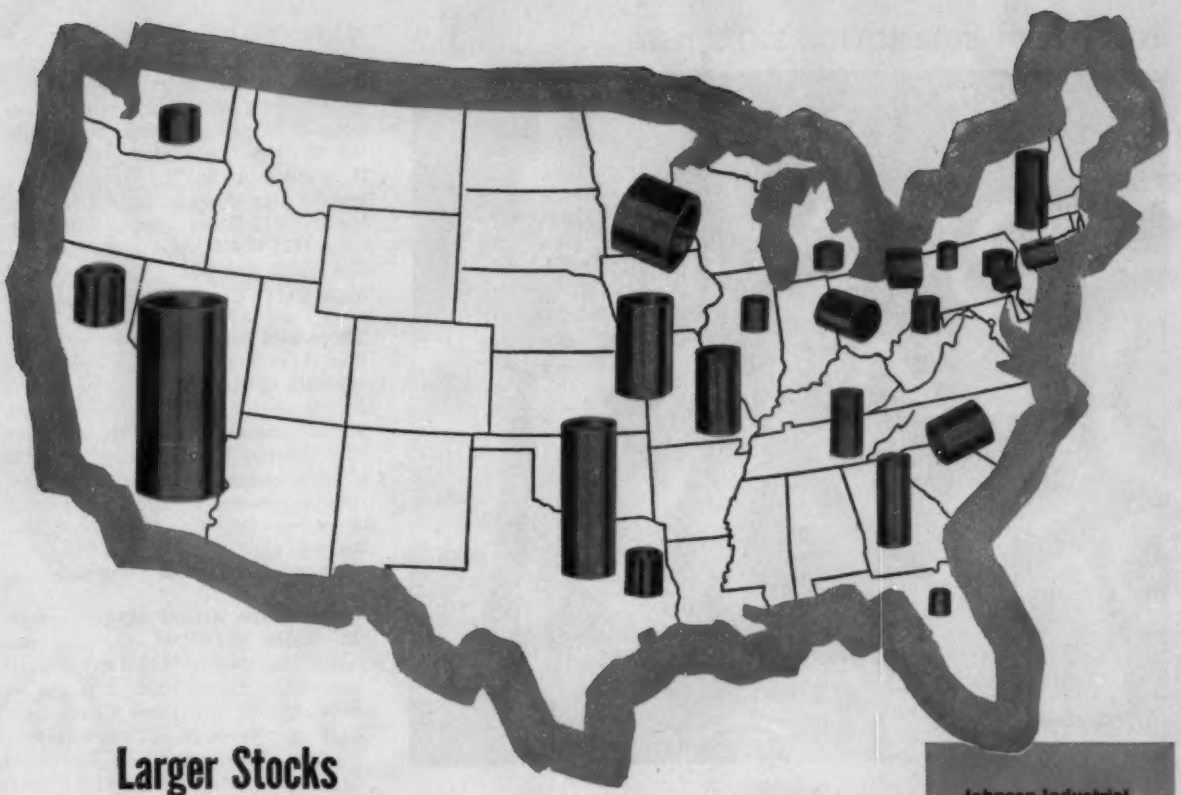
Uncut resins, direct from the cooking vat and particularly well suited for metalizing, permit adjustment of solids content and viscosity by the user to meet specific needs. They are suitable for thinning with low-cost, readily available materials with flash points above 100 F—*Schwartz Chemical Co, 50-01 Second St, Long Island City 1, N Y*

MORE DATA? Circle 101, inside back cover

New line of universal mounting brackets that will adapt Carter band saw guides to any machine permit ready replacement of any old-style No. 2,1,0,00 or three-roller type guide with new Guidall 400 or Micro-Precision guides — *Carter Products Co, Inc, 421 Helmer Bldg, Grand Rapids 2, Mich*

MORE DATA? Circle 102, inside back cover

"Guess what just opened up across from the plant."



Larger Stocks of Johnson Standard Stock Bearings Are Available NOW from Your Johnson Distributor

Increased demand for Johnson Bronze standard stock bearings has been met by adding larger stocks of these quality bearings in warehouses across the nation.

Satisfied users of these bearings testify to their quality . . . and the savings they provide.

Cost-savings result from the economies of volume production and elimination of tool and die charges. *Time savings* result from fast shipment from distributor stocks.

Don't pay extra for special bearings you don't need. More than 900 stock bearing sizes in 214 different ID-OD combinations and 21 lengths are yours to choose from.

Get complete details on these quality bearings by contacting your nearby Johnson distributor or by writing to Johnson Bronze Co., New Castle, Pa.

Johnson Industrial Distributor Stocks Are Supported by this Network of Johnson Warehouses

Atlanta
Buffalo
Cambridge
Charlotte
Chicago
Cincinnati
Cleveland
Dallas
Detroit
Houston
Kansas City
Los Angeles
Minneapolis
Newark
New York
Oakland
Philadelphia
St. Louis
Seattle

Johnson Bronze Company

New Castle, Pa.

West Coast Plant: Oakland 8, Calif.

GRAPHITED
over 175 sizes

GENERAL PURPOSE
over 900 sizes

UNIVERSAL BRONZE BARS
over 400 sizes

POWDER METALLURGY
over 400 sizes

ELECTRIC MOTOR (EM)
over 350 sizes

TORIT DUST COLLECTION ENDS THIS:

"OUT OF PRODUCTION FOR THREE DAYS? THAT'S WHEN WE'RE SUPPOSED TO SHIP!"

"And believe me, that wasn't all the boss said! Two key machines were so clogged with dirt and grime we had to disassemble and clean them—overnight! Between overtime for the repair crew and our own crew, I managed a partial shipment in three days. And I made up my mind this wasn't going to happen again!

"I'd heard of preventive maintenance with Torit Dust Control equipment—and the Torit representative I called sure opened my eyes! Clean machines hold close tolerances better and up to 80% longer! Torit collectors remove over 99% of dust and air-borne debris, save on both the cost and frequency of servicing.

"I expected there'd be a hitch on prices—but look what I found out: our production breakdown cost nearly as much as the Torit equipment we needed! And just while Torit Dust Collectors are being depreciated we'll make money on them —through maintenance savings, improved production, and reduced down-time!

"The boss actually congratulated me when I showed him the savings Torit preventive maintenance gives us!"

Torit Dust Collectors stop dust build-up before it costs you money. They're available in both high efficiency cyclone and cabinet type units. Why not check into them today—write:

TORIT manufacturing company
Dept. 425, 1133 Rankin St., St. Paul 16, Minn.

NEW SHOP EQUIPMENT

Airline lubricator permits cleaning or replacing of quick change bowl without interrupting operator using the air tool. Designated Model 3014, it is available in ¼, ⅜, and ½-in. female pipe threads. It is 9 1/16 in. high and 3½ in. wide—*Wilkerson Corp, 1671 W Girard Ave, Englewood, Col*

MORE DATA? Circle 103, inside back cover

Three-part contact seal, called Sealmaster, is available in pillow blocks and two or three bolt flange models for flush or recessed mountings. These contact seals, with the low-cost L series hearing units, come in a wide range of shaft sizes—*Sealmaster Bearing Div, Stephens-Adamson Mfg Co, Ridgeway Ave, Aurora, Ill*

MORE DATA? Circle 104 inside back cover

Plug-in type digital readout called the Series 80oooP is especially designed for in-the-field use. Overall size of the digital readout is 3¼ in. wide, 5¼ in. high, and 13 in. long. Unit is priced at $47.00, including mating plug—*Industrial Electronic Engineers, Inc, 5528 Vineland Ave, North Hollywood, Cal*

MORE DATA? Circle 105, inside back cover

Complete line of standard forming and cutting off tools for producing American Standard Machine Screws on Brown & Sharpe automatic screw machines are designed to make flat head, round head, oval head, or oval fillister head machine screws to specifications from size No. 0 to ⅜ in. It can be used on No. 00, 0, and 2 B&S machines—*Somma Tool Co, Inc, 109 Scott Rd, Waterbury, Conn*

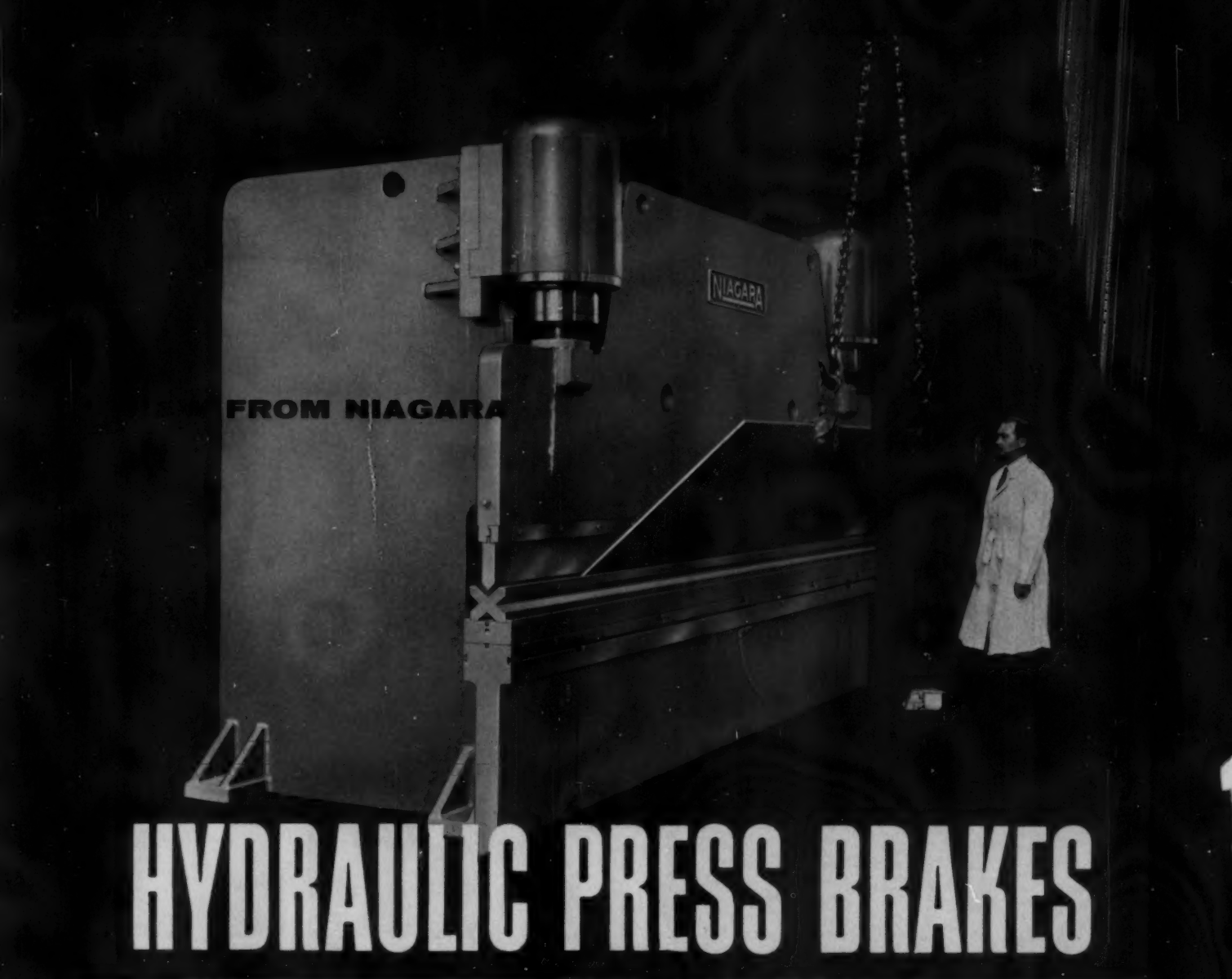
MORE DATA? Circle 106, inside back cover

Tracer stylus sets, for use with 360° and 3D duplicating, are available with round nose for ball end mill work or square nose for flat end mills. Each set contains 30 styli (0.125-1.062 dia) and is packed in hardwood case—*True-Trace Corp, 9830 Rush St, El Monte, Cal*

MORE DATA? Circle 107, inside back cover

Adapter for Surfindicator (unit for measuring surface finish) has chisel point which permits surface measurements of cutting edges, knife edges, and components with very small outside diameters, such as coil winding wire. Designated Model BL-130, it is an accessory to general purpose pickup of Surfindicator BL-110—*Brush Instruments, Div of Clevite Corp, 37th and Perkins, Cleveland 14, Ohio*

MORE DATA? Circle 108, inside back cover



FROM NIAGARA

HYDRAULIC PRESS BRAKES

44 MODELS OF SMOOTH-ACTION POWER!

. . . from 200 to 1000 ton capacities . . . up to 24 ft. working lengths

It was bound to happen: the development by Niagara of a companion line of hydraulic press brakes . . . the best obtainable today.

Designed for long stroke work at constant tonnage, these all-new machines complement Niagara's long-established mechanical press brake series. Together, they cover a tremendous range of sizes and capacities . . . *the most complete in the industry!*

As in the development of Niagara's mechanical press brakes, nothing has been spared in designing the hydraulic HD Series. Features like these are the direct result.

- *UNITIZED HYDRAULIC SYSTEM* . . . compact and easily accessible
- *NEW RAM LEVELING AND TILT CONTROL* . . . maintains accuracy *without* complex hydraulic or electronic devices
- *LAMINATED, NON-METALLIC WAYS* . . . prevent welding or galling of bearing surfaces
- *SELF-ALIGNING BALL JOINTS* . . . apply force uniformly to ram without binding
- *DEEP, RIGID BED* . . . interlocked to frame
- *FRONT-OPERATED, LOWER LIMIT RAM ADJUSTMENT* . . . with dial type counter for fast duplication of previous settings
- *ADJUSTABLE TOP AND BOTTOM STROKE STOPS* . . . conveniently located
- *TELL-TALE FILTERS* . . . guardian of the hydraulic system

But this only *begins* to tell the story. For complete facts and figures, request Bulletin 91.

Niagara Machine & Tool Works, General Offices and Works: 683 Northland Avenue, Buffalo 11, N. Y., U.S.A. District Offices and Distributors everywhere.

NIAGARA

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

CIRCLE 261 READER SERVICE CARD

THE
TIMKEN
ROLLER BEARING
COMPANY

REPORTS SAVINGS...

7 TO 1 REDUCTION IN... DIAMOND WHEEL COSTS

4 TO 1 REDUCTION IN... GRINDING TIME

WITH

ANOCUT
ELECTROLYTIC GRINDING

THE TIMKEN ROLLER BEARING COMPANY

CANTON 6, OHIO, U.S.A.
TELEPHONE: GLENDALE 2-4311
CABLE ADDRESS "TIMROSCO"

June 3, 1960

Mr. C. R. Stroupe
Vice President
ANOCUT ENGINEERING COMPANY
631 W. Washington Boulevard
Chicago 6, Illinois

Dear Mr. Stroupe:

We are pleased to report that The Timken Roller Bearing Company now has a total of nine Anocut units in operation in the Canton, Columbus, and Bucyrus Divisions.

Seven of these are 300 and two are 600 ampere units. The seven 300 ampere units are used on 6" x 18" Norton Surface Grinders for chip breaker grinding operations. Three of these units are in a dual setup whereby a switch kit is used to switch the Anocut unit to a Porter-McLeod Cut-Off Machine. These cut-off machines are used to salvage chipped tools and cut carbide to special lengths.

The two 600 ampere units are used on Hammond SCE-10 dual table oscillating grinders. On these latter machines, we are, for example, removing .045" of solid carbide in 45 sec. from a tool approximately ½" square, processing two tools simultaneously.

We are realizing a savings of 7 to 1 in diamond tool costs, and a reduction in grinding time of approximately 4 to 1.

C. A. Lease
Mechanical Engineering Department

OFF-HAND GRINDING SINGLE POINT TOOLS ON HAMMOND 10" DUPLEX ELECTROLYTIC GRINDER.

ELECTROLYTIC CHIPBREAKER GRINDING ON NORTON SURFACE GRINDER.

Youre Invited...

TO VISIT THE ANOCUT DISPLAY CENTER AND PLANT DURING THE COMING MACHINE TOOL EXHIBITION IN CHICAGO, SEPTEMBER 6 - 16th.

ANOCUT
ENGINEERING COMPANY
631 WEST WASHINGTON BLVD. • CHICAGO 6, ILL.
PHONE STATE 2-5480

FIELD REPORT...

Allis-Chalmers Acquires Half Interest in Electronics Firm

Allis-Chalmers Manufacturing Co of Milwaukee has entered into joint ownership with Bell & Howell of an electronic systems engineering firm in California. A-C has acquired 50% of the common stock of Consolidated Systems Corp, Monrovia, a wholly owned subsidiary of Bell & Howell's Consolidated Electrodynamics Corp. CSC employs 525 people, one-third of whom are technical personnel. Operations include administrative, engineering, and manufacturing facilities. Joint ownership venture integrates Allis-Chalmers capabilities as a major manufacturer of heavy industrial equipment with the technical resources of a firm which has pioneered in the development of the systems engineering concept. A-C feels that through the association it has strengthened its resources for supplying fully integrated systems in the industrial field.

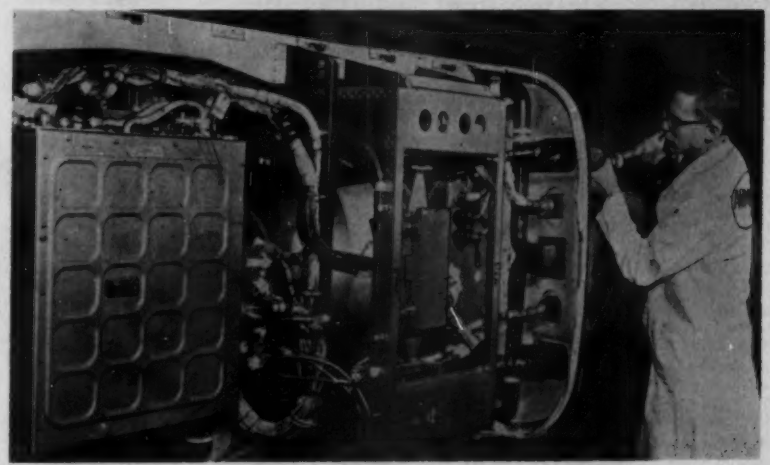
Lockheed Opens Plastics Center

Lockheed's California Division has opened a $3 million plastics center in Burbank to expand development and manufacturing work in the growing market. The 100,000 sq-ft facility will be used exclusively for development and production of aerospace and consumer plastics products. More than 400 technicians and engineers currently are assigned to the company's plastics projects.

Porter Acquires French Firm

H K Porter Co, Pittsburgh, has taken over Acieries & Ateliers de Construction de Marpent, French producer of steel, railway cars, and components, plus a variety of other industrial products. This marks the biggest step so far in Porter's long-range program to establish itself in international industry. It'll operate Marpent with a double purpose—to market its present products, and to serve as a base for the marketing of Porter products from the US.

Facilities of the French company, founded in 1882, include a steel plant with an electric furnace and an open hearth furnace supplying 150 tons of steel per day; two Bessemer converters; a foundry and two forges; a machining plant equipped with 178 heavy machine tools and a complete range of production and finishing equipment; an assembly plant with 68 machine tools including heavy presses up to 2000 ton capacity. It employs approximately 1200.



Inertial guidance system such as the one that successfully steered an Atlas ICBM on the first all-inertial flight June 11 is here installed in pot on outside of rocket case. To put the missile in the target area thousands of miles away, the unit requires extreme care and a high degree of precision in its manufacture at Arma Division of American Bosch Arma Corp. Sphere behind framework (center) contains the inertial platform which is held steady in space by two gyros. Three accelerometers and three pendulums on the platform send information to the transistorized solid-state digital computer (in box, left) that calculates direction, speed, and position as missile speeds downrange to the target area. The inertial guidance system is independent of ground station control and cannot be jammed by outside interference. Pushing toward smaller, lighter units, Arma is developing a second-generation control system and is already working on the micro-miniaturization required for a third generation

$7 Million Truck Order

New trucks worth $7 million have been ordered by Railway Express Agency for service throughout the country. Contracts to furnish the 1462 vehicles will be carried out by Ford Motor Co; General Motors Truck & Coach Division; Dodge Division of Chrysler Corp; Fruehauf Trailer Co; Mark Body Corp, Detroit; and Swift Body Co, Sandusky, Mich.

Vickers Sets Up New Facility

New manufacturing facility for cylinders has been established in Waterbury, Conn, by Vickers Inc. Designed for production of standard hydraulic cylinders for the industrial and marine and ordnance fields, new plant includes complete engineering, manufacturing, processing, raw stores, and warehousing facilities. In

McGIRK'S WORKS by GEO. CRENSHAW

WE NEED SOME TRANSPORTATION TO MAKE THIS RUSH DELIVERY.
SORRY, BUT EVERY TRUCK, TRAILER, PICK UP, TRAM AND SLED WE'VE GOT IS IN USE.
TRANSPORTATION
OKAY. THEN JUST GIVE US A DOLLY.
I'M ALL OUT OF DOLLIES TOO.
WELL.. HAVE YA GOT JUST AN OLD WHEEL LAYIN' AROUND WE COULD USE?
YUP! I'VE GOT LOTSA OLD BROKEN DOWN WHEELS.
MOE'S CORNER
THIS END UP

Two Hardness Testers in a Single Instrument

The new Wilson Rockwell TwinTester combines in one instrument the functions of both a Rockwell and a Rockwell superficial hardness tester. Designed primarily for use in such areas as tool departments, maintenance repair shops and laboratories, the TwinTester offers many outstanding features.

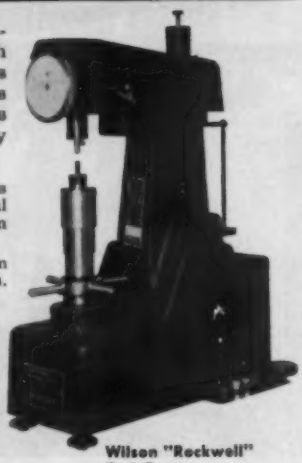
Large direct-reading dial is marked with B and C scales for Rockwell hardness, and N and T scales for superficial Rockwell hardness readings. Just one zero set position for all scales.

Easy to operate, the TwinTester can be changed from Rockwell to Rockwell superficial testing in seconds.

Complete equipment includes cowl, ball penetrator for B and T scales, Rockwell test blocks, anvils, dust cover and protective sleeve set.

A complete line of Wilson Rockwell instruments is available, including semi and fully automatic models. Wilson "Brale" Diamond Penetrators assure perfect readings every time.

Write for details—Ask for Catalog RT-58. It gives complete information on the TwinTester as well as on the full line of Wilson Rockwell hardness testers.



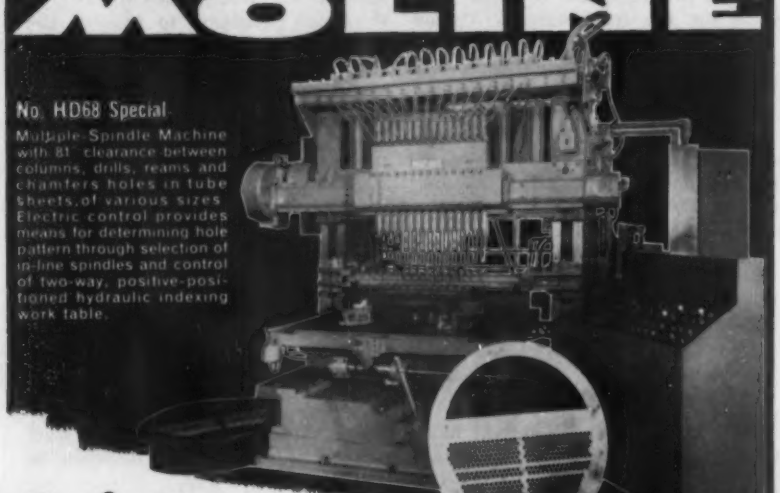
Wilson "Rockwell" TwinTester

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York
CIRCLE 264 READER SERVICE CARD

MOLINE



No. HD68 Special
Multiple-Spindle Machine with 81" clearance between columns, drills, reams and chamfers holes in tube sheets of various sizes. Electric control provides means for determining hole pattern through selection of in-line spindles and control of two-way, positive-positioned hydraulic indexing work table.

For Greater
PRODUCTION • EFFICIENCY • SAVINGS

Use an individually designed "Hole-Hog" Machine Tool for such jobs as:

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

Over 55 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.

MOLINE TOOL CO. MOLINE, ILL.

MOLINE TOOL COMPANY
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REPRESENTATIVES IN PRINCIPAL CITIES

107

Field Report . . .

addition to off-the-shelf service to customers, it'll enable the company to furnish special non-standard cylinders as well as prototypes to meet special requirements.

Avondale Shipping Order

Avondale Marine Ways, New Orleans, has a $15.8 million Navy contract to design and construct two rocket-armed destroyer escorts. Engineering work on the two vessels will begin immediately and keels will be laid in ten months. Avondale currently has a contract to build two guided missile destroyers for the Navy and construction of these vessels will be carried on at the same time. Cost of these is approximately $35 million.

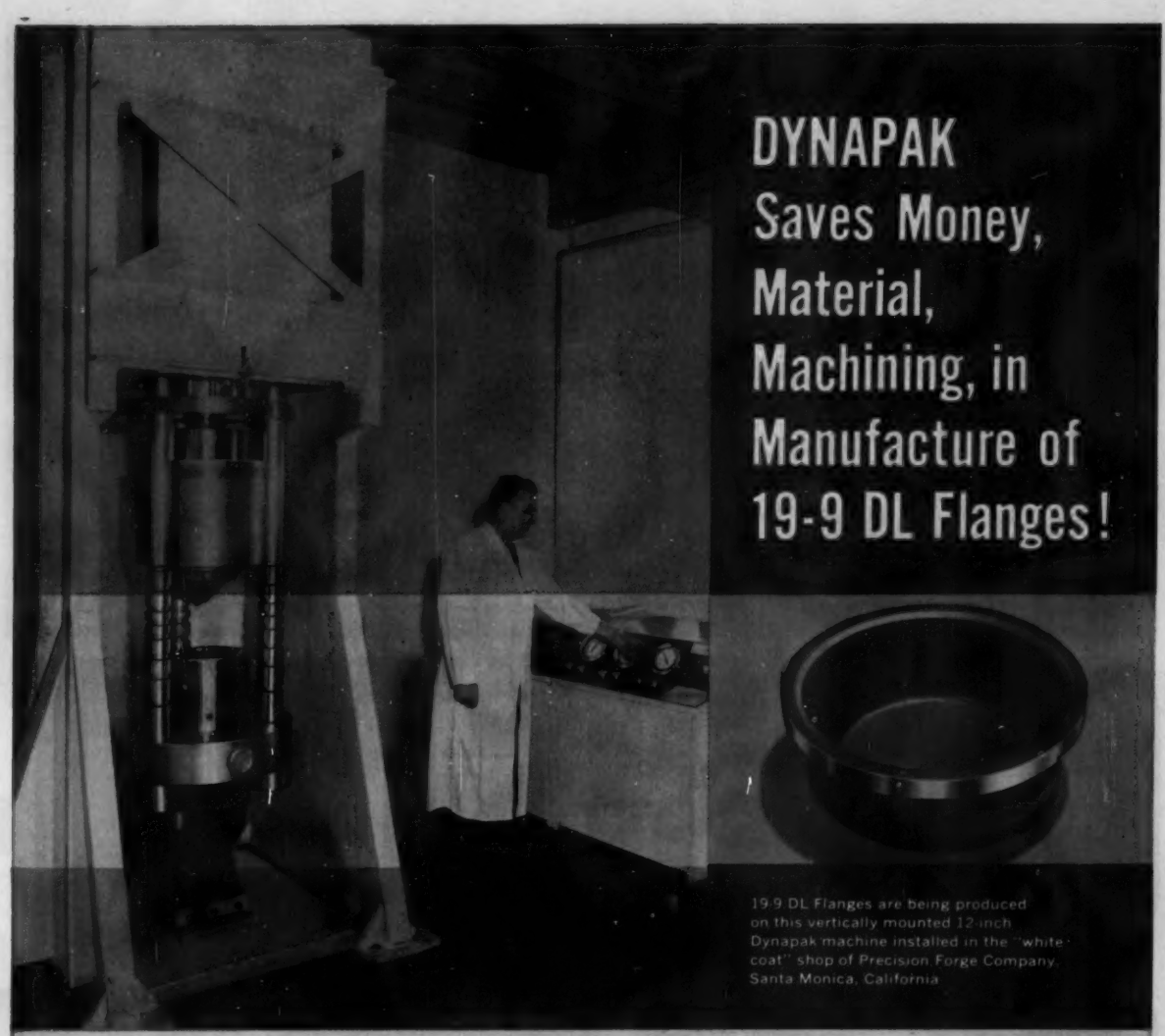
Fisher Adds Space at Willow Run

Work has started on a 264,750 sq-ft addition to the Fisher Body plant at Willow Run. Facility makes bodies for the adjoining Corvair plant. Expansion, which will boost floor space to 823,400 sq ft, will be completed by February.

Big Order for Rocketdyne

A $44 million contract for an advanced liquid hydrogen rocket engine has been awarded to Rocketdyne by the National Aeronautics and Space Administration. Engine will be used to power upper stages of advanced versions of the Saturn rocket. It'll produce 200,000 lb of thrust and may be grouped in clusters of two or four engines in the vehicle.

"Nope, haven't talked to my wife for 10 years —didn't want to interrupt her!"



DYNAPAK Saves Money, Material, Machining, in Manufacture of 19-9 DL Flanges!

19-9 DL Flanges are being produced on this vertically mounted 12-inch Dynapak machine installed in the "white coat" shop of Precision Forge Company, Santa Monica, California.

Here are the savings achieved in this Dynapak Application:

- MATERIAL: 60%
- TOOLING: 50% of the cost of conventional forging dies
- MACHINING: Reduced by more than 50% due to forging tolerances of 1/32 in. and elimination of draft angle.

PLUS

- PRODUCTION RATES: 70-80 per hour
- SUPERIOR PHYSICAL CHARACTERISTICS: Greater strength, uniform and controllable work-hardening, Grain Size No. 11.

Dynapak, industry's first operational high-energy-rate machine tool, offers a breakthrough in metalworking's long-sought goal to produce forgings that can be used with little or no machining. This flange is just one of many forgings now being produced commercially by Dynapak. For complete information regarding application of pneumatically-energized Dynapak in your forging, extrusion, forming, or compaction operations, write, wire, or phone:

DYNAPAK

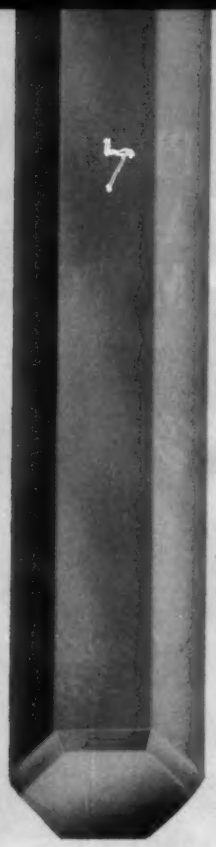
CONVAIR / A DIVISION OF GENERAL DYNAMICS CORPORATION

1243 Transit Avenue, Pomona, California • Telephone: NAtional 3-1561

CONSISTENT

MACHINABILITY!

CIRCLE 267 READER SERVICE CARD



Every rod... every bar of new Kaiser Aluminum Micro-Chip 2011-T3 delivers consistently superior machining, not only from lot to lot but throughout every length. It can help you set new records in production speed and quality control. Here's how:

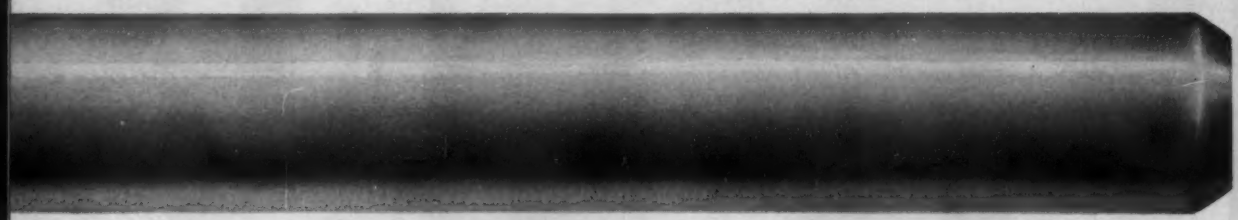
1 LESS RESETTING OF TOOLS—The new Kaiser Aluminum Micro-Chip process makes Micro-Chip uniform in machining characteristics. Consistent machinability means less resetting of tools... less down time... and lower unit costs.

2 FASTER MACHINING—Micro-Chip turns out finer, smaller chips... increases machining surface speeds as much as 40% over other standard screw machine alloys. Micro-Chip produces a maximum number of parts with minimum tool wear.

3 BRIGHTER, CLEANER SURFACE—Micro-Chip stock is delivered cleaner and brighter. Even portions not machined have a quality finish without special handling.

4 BOTH ENDS CHAMFERED†—Chamfering at both ends of Micro-Chip rod and bar eliminates awkward work of reversing metal for entry into machine—reduces feed finger wear.

†From ½" to 2" inclusive.



NOW—MICRO-CHIP IS IN STOCK EVERYWHERE! CALL YOUR KAISER ALUMINUM DISTRIBUTOR • Kaiser Aluminum Micro-Chip is now available for immediate delivery through Kaiser Aluminum Distributors or your Kaiser Representative. Micro-Chip comes in 12-foot lengths, up to 3-inch diameter and 2-inch hex in standard 200-pound packages—at **no increase in price** over regular 2011-T3. Ask for "Micro-Chip" and look for the label.

KAISER ALUMINUM & CHEMICAL SALES, INC.
Kaiser Center, 300 Lakeside Drive, Oakland 12, California

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local listing

KAISER ALUMINUM

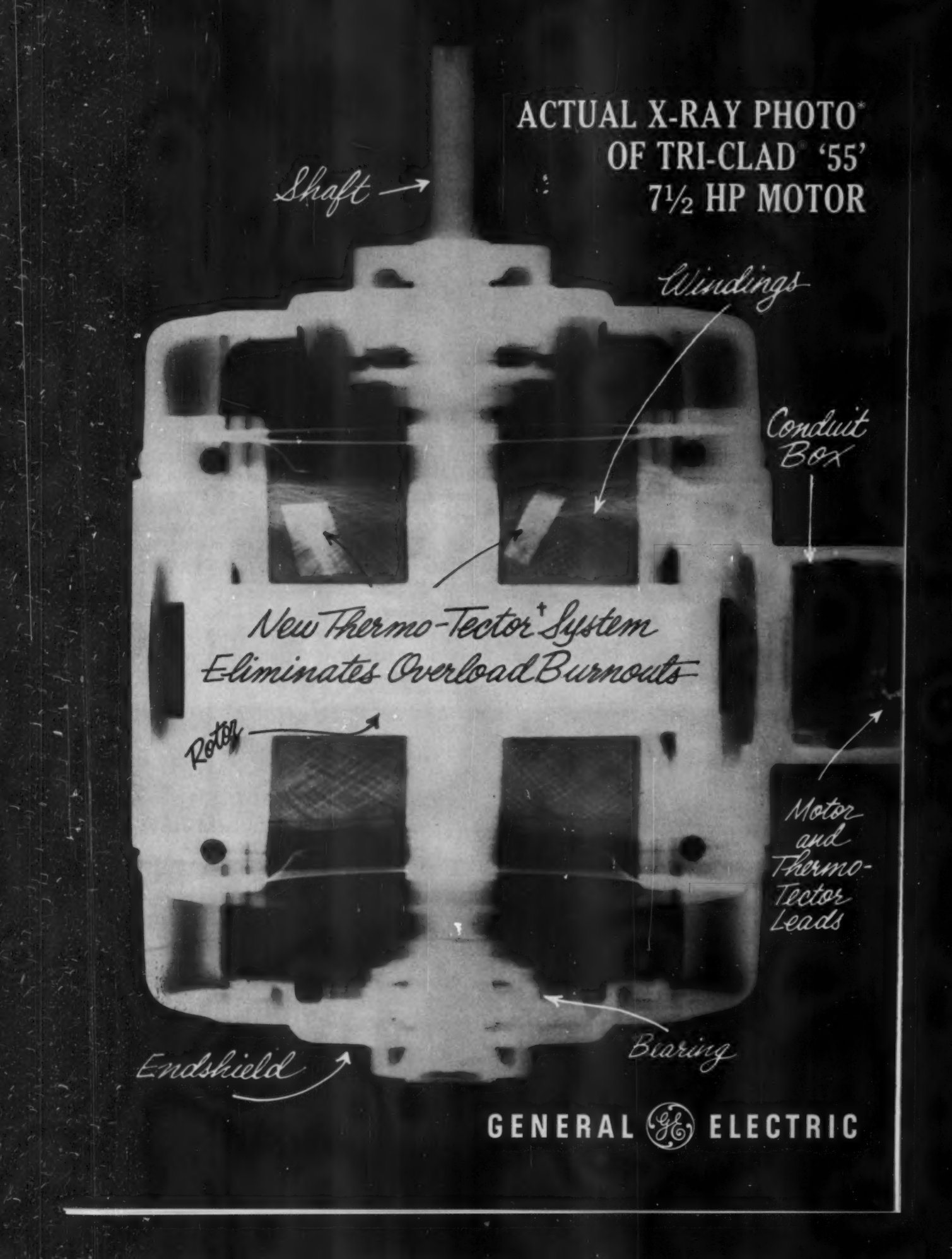
TRADEMARK OF KAISER ALUMINUM & CHEMICAL CORPORATION

MICRO-CHIP

2011-T3

*TRADEMARK KAISER ALUMINUM & CHEMICAL CORPORATION

CIRCLE 260 READER SERVICE CARD


ACTUAL X-RAY PHOTO* OF TRI-CLAD® '55' 7½ HP MOTOR
Shaft
Windings
Conduit Box
New Thermo-Tector† System Eliminates Overload Burnouts
Rotor
Motor and Thermo-Tector Leads
Endshield
Bearing
GENERAL ELECTRIC

Exclusive General Electric Thermo-Tector† System Eliminates Overload Burnouts

ALLOWS MAXIMUM MOTOR OUTPUT— SAFELY!

Now—Tri-Clad '55' motors have simple, direct-acting thermal protectors that positively prevent overload failures!

New Thermo-Tector heat-sensing switches buried in motor windings react *instantly* to prevent heat damage. Unique Thermo-Tector "anticipation" feature varies motor shutoff point according to rate of winding heat rise. This ends need for operating safety margin, allows you to get *full output* from Tri-Clad '55' motors.

Thermo-Tector system requires *no costly amplifying relays*—works with any conventional G-E motor controller. Thermo-Tector protection is available on *all* Tri-Clad '55' motors in frames 254U-445U.

For more information, contact your General Electric Apparatus Sales Office or write for Bulletin GEA-7092, Section 866-01, Schenectady 5, New York.

*Photo made from radiograph taken with 1,000,000-volt G-E Resotron® X-ray machine at General Electric's Large Steam Turbine-Generator Department.

†Trade-mark of General Electric Company.

SMALL AC MOTOR & GENERATOR DEPT.

GENERAL ELECTRIC

SCHENECTADY 5, NEW YORK

Field Report . . .

$18.8 Million Order to Martin

New contracts have gone to Martin Co, Baltimore, for continued production of Lacrosse missiles and ground support equipment, engineering services and maintenance. The missile is produced at the company's Orlando, Fla, Division. Martin also has an $8 million AF contract to begin work on a bigger and better Titan ICBM. New weapon, called Titan II, will be powered by so-called storable fuels which will make it possible for it to be fired almost instantly.

Timken Adds New Tube Mill

Timken Roller Bearing Co has a $4.5 million tube mill under construction at its Gambrinus plant. The company's fourth, it'll increase output by about 30%. Increased capacity in regular sizes will also enable Timken to produce tubing with larger outside diameters at its No. 3 mill at Gambrinus. Mill is expected to be ready for operations this time next year.

Barry Controls in Merger

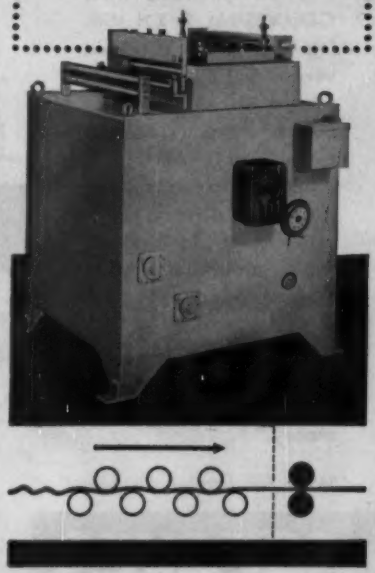
Negotiations are under way for merger of Barry Controls of Watertown, Mass. and Wright Line of Worcester. Merged firms would be known as Barry-Wright Corp. Barry makes shock and vibration isolators and suspension systems for aircraft, missiles, electronic equipment, and industrial machinery. Wright Line produces accessory and punched-card handling equipment for data processing and computing systems.

"How come you're never around when I do something right?"

new

benchmaster

Combination Feeding and Straightening Machine



Feeds measured lengths of coiled, strip or flat stock to presses, shears and other machines. Simultaneously removes kinks, moderate curl, camber, etc., with 9 adjustable power-driven rolls. Equipped with electro-magnetic clutch drive and adjustable timer for delivering measured feed lengths.

TWO MODELS: Single clutch for nominal feed accuracy or double clutch for increased feed accuracy. Standard feed range 0-60". Alternate ranges on request. Special timer bypass extends range to any length required. Models available for material to 50" wide, various gauges. Larger sizes are available on special order.

WRITE FOR NEW DESCRIPTIVE CIRCULAR!

benchmaster

World's largest manufacturer of small punch presses and mills.

1835 West Rosecrans Avenue, Gardena, Calif.

new GREAVES 2-XH Milling Machines

More power at the cutters

The completely new GREAVES No. 2-XH Milling Machine brings added versatility, increased operational ease, and more power where it's needed most . . . *at the cutter!*
It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

- Wide range of speed/feed combinations for any type material, any type job.
- Heavy, internally ribbed column casting and heavy duty rectangular overarm for maximum rigidity.
- Large, heavy-duty knee, saddle and table provide accuracy for all types of milling.
- New 7½ HP spindle drive motor, with separate motor for movable components, provides extra power for heavy milling.
- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

Write for detailed literature!

GREAVES

J. A. FAY & EGAN COMPANY
2100 Eastern Avenue, Cincinnati 2, Ohio

CIRCLE 271 READER SERVICE CARD

From the *American Machinist* Library of *Tips for Top Shop Men*

BUILD a good reputation in your community. Morale and efficiency usually are high in the plant that is known as "a good place to work."

Field Report . . .

Alabama Metallurgical Corp . . .

. . . will double the size of its new $3.5 million magnesium production plant at Selma. Present processing capacity is a million pounds per month. Company is owned primarily by Calumet & Hecla, Chicago, which is also the parent of Wolverine Tube Co. Proposed expansion will cost between $4 and $5 million.

Aeronca Purchases United Welding

Aeronca Manufacturing Corp, Middletown, Ohio, has acquired United Welding Co, same city. Cash purchase includes a lease with option to buy on land, buildings, and equipment. The welding company was formerly a division of Baldwin-Lima-Hamilton Corp which is consolidating its operation in Eddystone, Pa. UW currently produces a variety of components for diesel engines, machine tools, earth-moving equipment, and similar large equipment items including complete special machinery.

Sterling Electric Acquired

Acquisition of Sterling Electric Motors, Los Angeles, by Hathaway Instruments of Denver for $2.5 million in cash has been approved by directors of both corporations. Sterling stockholders will vote on the proposal.

Fairchild Semiconductor Corp. . . .

. . . has laid off 200 workers at its Mountain View, Calif, plant which makes silicon transistors. Step was reported to be the result of production increases brought about by new techniques.

"Tape controlled machines are nothing new. Half our machines are held together with tape."

EASTERN

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low cost
HYDRAULIC KEYSEATER
cuts standard, tapered keyways ¼" to 2" wide

- fast set-up—saves time and money
- low cost operation-uses standard tool bits
- heavy-duty hydraulic circuit—assures accurate keyways
- compact, 21" x 61"—no special foundation

Send for Bulletin 34

E. W. BLISS COMPANY
CANTON, OHIO

CIRCLE 274 READER SERVICE CARD

NEW Automatic Loading and Feeding for Grieder Tube Cut-Off Machines ... 4500 to 6500 cut-offs per hour!

The Grieder automatic loader and feeder holds up to 15,000 pounds of tubing and will automatically feed the entire load through a Grieder Tube Cut-Off Machine without attention from the operator. Standard stock cradle handles 22' lengths. Shorter or longer capacities are available. Note! This equipment will also feed round stock to other types of machinery.

- Grieder Tube Cut-Off Machines cut tubing of any shape to any length faster than any other machine.
- Length tolerance plus or minus .002" on light wall tubing, .003" on heavier.
- Precision clamping dies prevent tube distortion and provide clean, quality cuts. Tube does not rotate.

Write for literature. Tell us sizes of steel, copper, brass, aluminum or alloy tubes to be cut and production requirements.

GRIEDER INDUSTRIES, INC.
P. O. Box 169 • Bowling Green, Ohio

Please send bulletin describing Grieder Tube Cut-Off Machines.

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COMPANY_____
CITY_____ ZONE____
STATE_____

Grieder
TUBE CUT-OFF MACHINES

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 METALWORKING MACHINES AND TOOLS —*W A Whitney Mfg Co, 636 Race St, Rockford, Ill.* 56-page catalog 60 illustrates and describes hydraulically operated Hydramic presses for punching, shearing, forming, notching, bending, coping, squeezing, and riveting. Also covers company's line of portable and bench-mounted hand-operated punches and presses as well as tooling for both hand and power-operated units. Hydraulically powered machines are from 5 to 90-ton capacity. Portable hand-operated shear for cutting corrugated steel or aluminum sections also described.

2 HARPER THREAD GUIDE—*H M Harper Co, 8200 LeHigh Ave, Morton Grove, Ill.* 16-page illustrated booklet offers a basic introduction to the varied types of threads. Briefly outlines history, defines terminology, and explains with diagrams the differences between the major kinds of screw threads. Charts detail measurements, characteristics, and capabilities of the standard thread types according to the Unified and American Thread Series, ASA B 1.1-1960. Additional charts describe characteristics of tapping screws and wood screws. Torque guide outlines normal load values that may be applied to bolts of various metals.

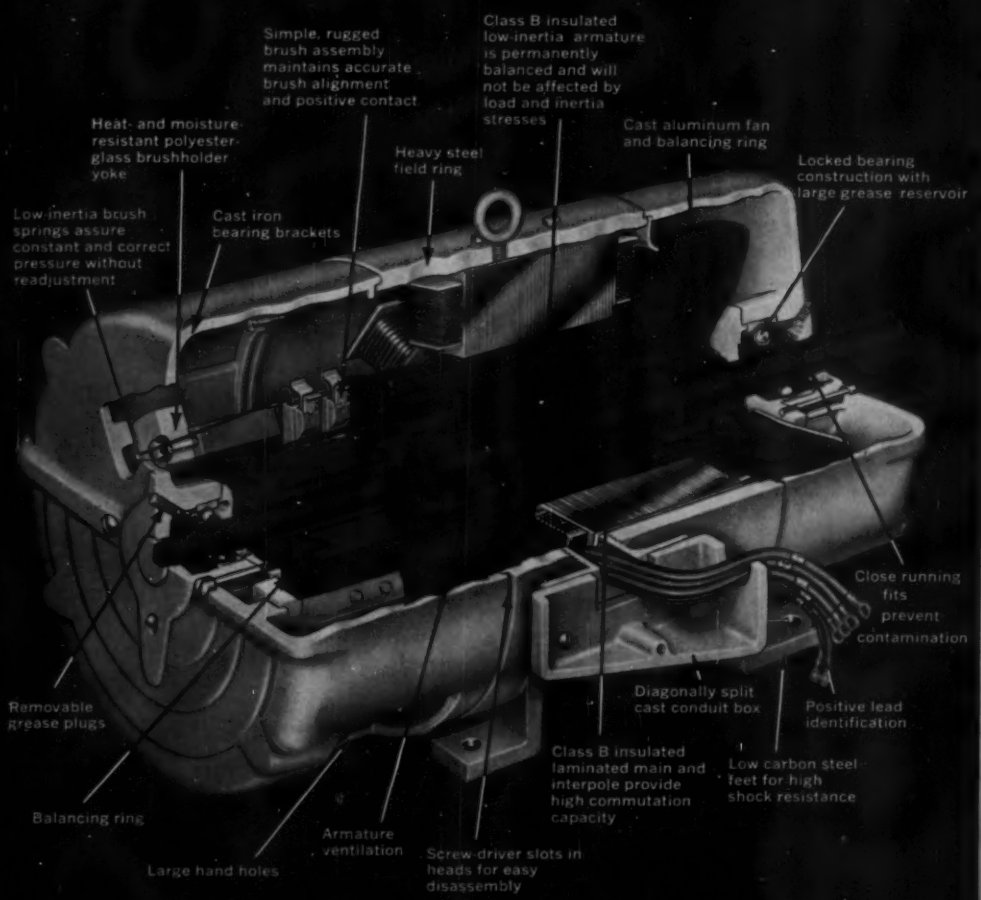
3 TUBE AND ROD END-FINISHING MACHINES—*Pines Engineering Co, 401 Walnut St, Aurora, Ill.* 4-page bulletin 401 pictures and describes new bench-type Model 660 for simultaneous deburring, facing, and chamfering operations on tube, rod, or pipe ends up to 2 in. dia. Larger floor-mounted models with capacities to 3 and 5 in., air-operated versions, and special double-end machines are shown and specifications given.

4 CHEMICAL MILLING —*Chemical Contour Corp, 16837 S Avalon Blvd, Gardena, Calif.* 4-page article discusses state of the art. Describes how it is used in processing steel and other metals on a mass-production basis. Advantages over machine methods cited.

5 INDEXING MACHINE CHASSIS—*Swanson-Erie Corp, 314 E Eighth St, Erie, Pa.* Illustrated bulletin describes Series MD double tool plate unit; covers design and application and lists principal operating features of the machine, a new

"You got it started? How did you do that?"

Here's the latest in D-C motor design:


Simple, rugged brush assembly maintains accurate brush alignment and positive contact
Class B insulated low-inertia armature is permanently balanced and will not be affected by load and inertia stresses
Heat- and moisture-resistant polyester-glass brushholder yoke
Heavy steel field ring
Cast aluminum fan and balancing ring
Locked bearing construction with large grease reservoir
Low-inertia brush springs assure constant and correct pressure without readjustment
Cast iron bearing brackets
Close running fits prevent contamination
Diagonally split cast conduit box
Positive lead identification
Removable grease plugs
Class B insulated laminated main and interpole provide high commutation capacity
Low carbon steel feet for high shock resistance
Balancing ring
Armature ventilation
Large hand holes
Screw-driver slots in heads for easy disassembly

...and some easy-to-add field modifications

A-c tachometer for speed indication

A-c motor-driven blower with permanent dry-type filter for easy mounting on bearing bracket

Magnetic disc-type brake with d-c series or shunt, or a-c coils

Helical single, double, and triple reduction gear units for all ratios

New Louis Allis FLEXITORQ® D-C MOTORS

...offer you vastly improved commutation–low brush wear– 400% short-time overload capacity–and unmatched flexibility!

Bear this in mind: The Flexitorq is *not* just another *rerated* d-c motor. It's *all new*—and it's been designed to give you more for your power dollar — in superior performance, matchless field flexibility, and unrivalled economy of operation and upkeep.

Advanced armature design and brush construction offers improved commutation, faster response, and lower brush wear. Class B insulation system provides exceptional thermal endurance... is rated for 60°C rise for continuous duty... and creates a barrier to moisture, acids, alkalis, and other contamination.

The net result to you is reliable, trouble-free power for constant and adjustable speed drives. For example, Flexitorq gives you 400% faster acceleration, plus much better deceleration, reversing, and speed changing. You can safely impose 400% intermittent and 15% continuous overloads — and the high-torque design is a welcome plus when you need extra power for hard-to-start machines.

The new Louis Allis Flexitorq is lighter and more compact than previous d-c motors... lets you squeeze more power into less space... yet is actually *easier* to service! Brushes and entire brush-holder assemblies can be quickly inspected and removed without major disassembly. And since brush springs remain conveniently attached to the brush holders, brush changing is a simple affair.

Flexitorq d-c motors are available in sizes from 1 to 400 hp — in various enclosures. See your nearby Louis Allis District Office for information and application help. Or write for Bulletins 3150 and 3200 to The Louis Allis Co., 462 E. Stewart St., Milwaukee 1, Wis.

LOUIS ALLIS

DC-217

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

YOUR BEST GUIDE TO
1960's RECORD BREAKING EXHIBITS
OF METALWORKING'S
EQUIPMENT AND SUPPLIES

WILL BE FOUND
IN THE

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a 200-page advance look at the Machine Tool Exposition, Production Engineering Show and Coliseum Machinery Show

authoritative descriptions of "WHAT'S NEW" in equipment, materials and supplies at each of the three expositions

a preview to help you plan your Chicago visit to make the most valuable use of your time

an authoritative reference for the things you examined and discussed during your visit

a comprehensive trip through the three exhibit halls if you are unable to attend

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ABC ABP

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A FAST, ACCURATE GAGE— WHERE AND WHEN YOU NEED IT!

The MICROtrol* 170 is a transistorized gaging system for use at the machine, in the gage laboratory or on the production line. Production personnel find it simple to use. The four types of gage heads available can be used interchangeably with the battery-powered amplifier.

Features

- *Only 2 control knobs*
- *One adjustment zeros both scales*
- *Large meter with 4.6" scale*
- *Dual range—from either ± .0003" to ± .003" or ± .001" to ± .010"*
- *Accurate—transistorized throughout*
- *Pocket-sized—5¾" square by 3 1/16".*
- *Mounting adapters and gage head stored in cover*
- *Carrying case handle doubles as amplifier stand*
- *Lightweight—weighs only 3 lbs.*
- *Battery powered—can be used anywhere*
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concept in automatic assembly and processing machine design. It employs a pair of overhead tool plates which reciprocate vertically with relative motion to the turret and with respect to one another. Tools are mounted on the lower plate and actuated by motion of the upper plate. Design provides positive parts control, permits standardization of tooling, and reduces jam potential.

TOOLS AND ACCESSORIES

6 TIME-SPEED RECORDER — *R B Annis Co, 1101 N Delaware St, Indianapolis 2, Ind.* Bulletin TS-60 provides information on portable instrument that detects hidden trouble in machine operations and processes. Device monitors automatic equipment, providing a graphic record of short duration events to millisecond accuracy, along with time-of-day information. Split-second timing makes it possible to locate equipment malfunction or other difficulties often missed by stop-watch time studies.

7 AUTOMATIC DRILL CHUCKS — *American Machine & Foundry Co, AMF Tool Division. 224 Glenwood Ave, Bloomfield, NJ.* Folder pictures and provides data on AMF Wahlstrom drill chucks specially designed for use on Moore jig borers. Model A is available with Moore taper shank in two sizes, ⅝ and ½-in. capacities. Tool changing without stopping the spindle can be accomplished. Use of this chuck makes it practical to spot, drill, and ream many different size holes successively on the jig borer without moving the work. It is also available for other makes of jig borers, as well as drillpresses, milling machines, motor shafts, and other special applications.

8 POWER TOOLS — *Skil Corp, 5033 Elston Ave, Chicago 30, Ill.* 8-page illustrated catalog provides condensed specifications on saws, drills, routers, planes, belt and disc sanders, shears, drivers, portable and bench grinders, polishers, blowers, pneumatic tools, and abrasive products. Lists 81 tools in all including recently introduced Recipro saw and Roto-Hammers.

9 WINDOW UNITS—*Bijur Lubricating Corp, Rochelle Park, NJ.* 4-page bulletin 8-E describes and pictures three types: Level Type for immediate visual check of liquid levels; Standard Type, primarily used to observe level, condition, or flow of reservoir-kept liquids; and Open Type for observation of internal machinery parts, observing or checking liquid flow, etc. Includes typical applications, diagrams

"I think he's slipping Al . . . He repeated himself twice. . . . while bawling you out . . ."

consistent quality

Consistent Quality stainless steel takes the guesswork out of any production operation. Tooling set-ups become standard. Rejects and reworking are reduced. Your plant and your product move smoothly.

J&L consistent quality stainless steel is as near as your telephone . . .

Call Western Union by number, ask for Operator 25

Western Union Operator 25 will give you the name of your nearest J&L stainless steel distributor. You'll find that he can further reduce your costs of using stainless steel by providing a complete selection of materials. He can save you the capital investment required to maintain long term inventories. He can provide a wide variety of preproduction services, and reduce your overhead for stocking, handling, accounting and obsolescence.

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J&L—a leading producer of stainless steel and precision cold rolled strip steels.

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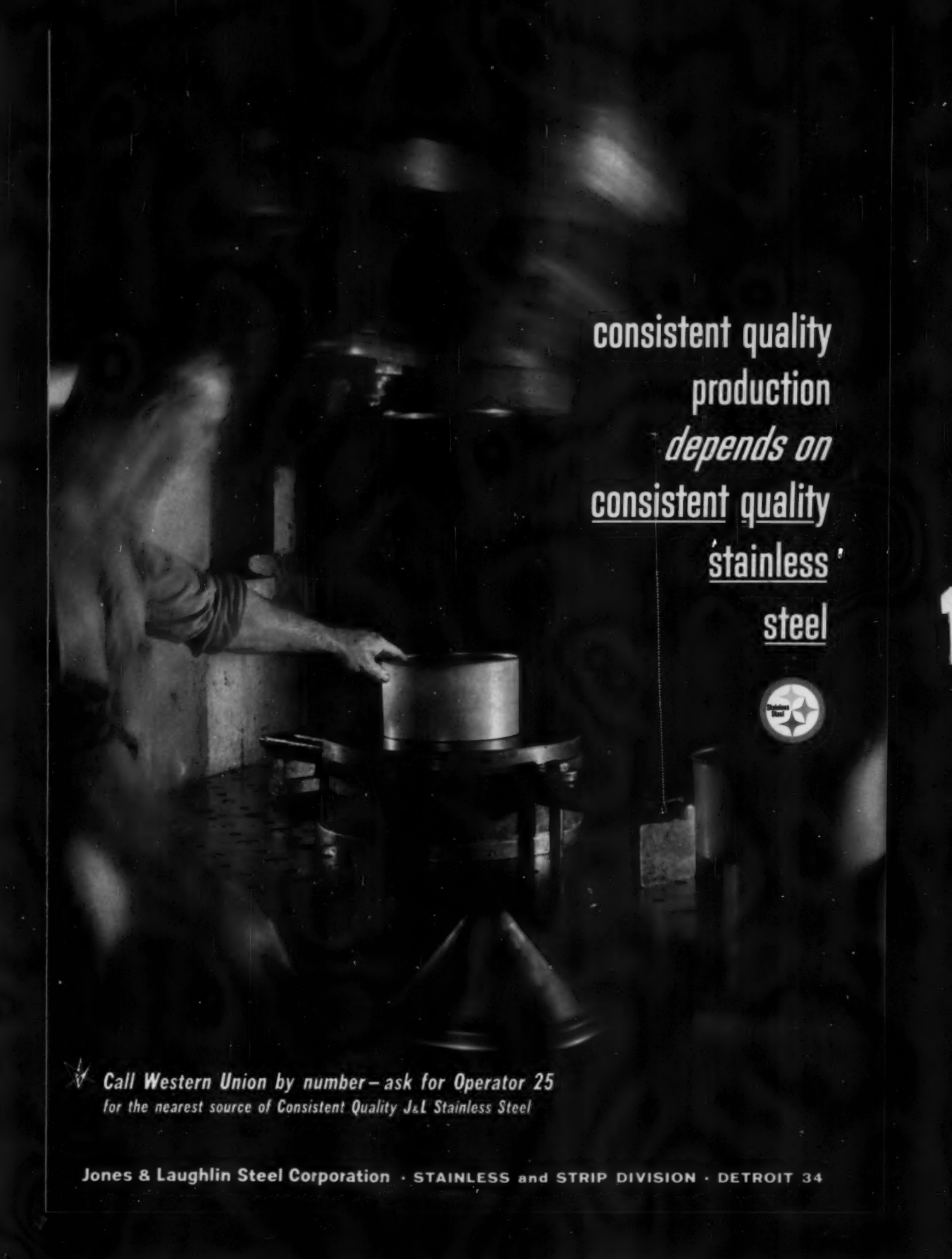

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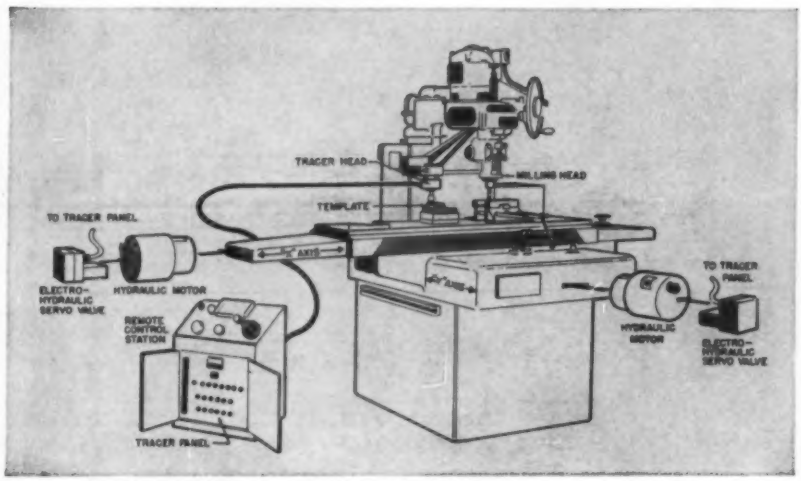
for modern, efficient
machine control . . .

Honeywell's new Electro-Hydraulic Servo Systems and Components



360° electro hydraulic tracer control system

Tracer control systems—fast, accurate and reliable system response for smooth application of large increments of hydraulic power. The flexibility, remote control and intelligence of electronics are coupled with the power and "tight" actuation of hydraulics.

Speed control systems—speed ranges of 1000 to 1, speed regulation to 0.1%, and consistent speeds to 1 rpm are possible with electro-hydraulic speed control.

Position control systems—positioning of cylinders or motors to the most exacting specifications.

Speed and position—synchronization and programming—control of tension, force, level, torque, etc.

For further information on Honeywell's new machine control systems and components, and their application to your specific job, call your nearest Honeywell office. Or write: Minneapolis-Honeywell, Department AM-7-12, Minneapolis 8, Minnesota.

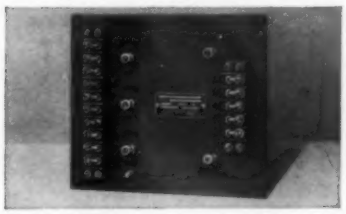
Honeywell

First in Control

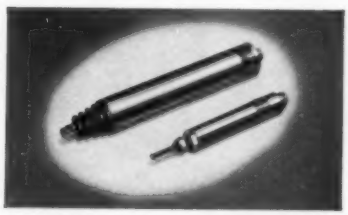
SINCE 1885

75th YEAR

Electro-hydraulic servo valves—2-, 3- and 4-way valves with output flow proportional to input signal. Designed specifically for industrial use.



Transistorized servo amplifiers—proportional and integrating low voltage amplifiers designed for servo systems, incorporating servo valves, d-c relay and servo motors.



Feedback transducers—industrialized linear and rotary transducers providing accurate sensing and feedback for servo loops.

Hydraulic motors—roll-vane motors producing high torques at low speeds. Often connected directly to load. Integral tachometer optional.

Servo accessories—input commands, meters, manifolds, phase conversion panels, consoles, etc., to complement the servo control systems.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

of each unit, and specification charts with listing of part numbers and sizes. Installation data provided.

10 MAGNIFYING COMPARATOR — *Finescale Co, 218 S Western Ave, Los Angeles 4, Calif.* Illustrated folder gives details on instrument for measurement and comparison of miniature parts and assemblies; includes five new reticles recently added to the 15 formerly available for use with it. New reticles include one having a grid pattern with 0.050 in. squares for use in measuring electronic wiring boards, and one having subdivisions of only 0.002 in., the finest so far available in any instrument of this type.

11 HAMMERS—*Hackett Brass Foundry Co, 1202 Lillibridge St, Detroit 14, Mich.* 2-page illustrated catalog covers copper and brass hammers with built-in safety features. In addition to hickory handles, line includes hammers with steel handles that are molded into the barrel heads as an integral part. Charts indicate weights, lengths, and types of handles available.

12 RECORDING OSCILLOGRAPH — *Consolidated Electrodynamics Corp, Electro Mechanical Instrument Division, 360 Sierra Madre Villa, Pasadena, Calif.* 8-page bulletin 1623 provides information on Type 5-123, a rack-mounted instrument capable of providing visible records up to 60 times faster than any other printout process. Applications illustrated.

13 ELECTRIC EYE—*Photomation Inc, 98 S Washington Ave, Bergenfield, NJ.* 6-page bulletin 577 covers design and application of Electric Eyes, miniaturized measuring instruments. Drawings illustrate construction and wide range of typical installations.

HEAT TREATING AND WELDING

14 SPRAYWELDER — *Wall Colmonoy Corp, 19345 John R St, Detroit 3, Mich.* 4-page illustrated bulletin 300D describes new Colmonoy Model D and its advantages. Contains step-by-step outline discussion of the Colmonoy Sprayweld Process. The five Sprayweld powders available for use with the unit are discussed; tabular data identifies composition, hardness, specific gravity, melting point, abrasion and corrosion resistance, impact and galling resistance, red hardness, and application recommendations. Typical applications illustrated and described.

15 AUTOMATIC WELDING — *Hobart Brothers Co, Troy, Ohio.* 6-page bulletin DM-144 illustrates and describes complete line of automatic and semi-automatic arc welding equipment. Applications for different automatic welding processes pictured.

16 BRAZING TECHNIQUES—*All-State Welding Alloys Co, 249-55 Ferris Ave, White Plains, NY.* 24-page illustrated manual discusses techniques on all commercial brazeable metals and alloys. Details such basic brazing functions as heat, flame and torch settings, alloy selection and joint design. Specific solutions to common problems are outlined in sections on copper and its alloys, aluminum, cast iron, steel, and stainless steel brazing.

17 SEAM WELDER BEARING—*Taylor Winfield Corp, 1048 Mahoning Ave, Warren, Ohio.* 4-page illustrated bulletin 6-023 contains information on rotating, current carrying bearings for resistance welders. Shaft spindle is mounted in tapered roller bearings assuring precise alignment. Electrical power is transferred by silver faced contacts. Entire bearing is oil im-

Tips to help you cut impact socket breakage

- Position power wrench so that socket fits straight on nut. Tilted wrench causes binding and socket breakage.
- Use right size socket . . . replace worn or undersize nuts. Loose-fitting sockets wear faster — then break.
- Don't keep impacting after nut is tightly set. This causes needless wear on both wrench and socket.
- Keep the inside of sockets clean. Dirt and grease are common causes of socket breakage.
- When power wrench drive head becomes worn — replace it. Loose drive causes excess wear in socket drive opening — early socket breakage.

Best tip yet!

ALWAYS USE *Snap-on* INDUSTRIAL SOCKETS

Sockets used on power nut runners and impact wrenches take a terrific pounding. Standard hand-wrench sockets are not designed for this work. *Snap-on* heavy-duty industrial sockets have the extra heft and toughness to take the beating. Result: more work-hours per socket and, equally important, less costly downtime resulting from frequent breakage of ordinary sockets.

Final tip. Talk sockets with your *Snap-on* man. Take advantage of his specialized tool knowledge, and his competent advice on what is best for you in the wide range of *Snap-on* industrial sockets. Your nearby *Snap-on* branch office provides prompt emergency or regular service.

FOR ALL INDUSTRY

SNAP-ON TOOLS

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COINING
EMBOSSING
FORMING
COLD STRIKING

Automatically

Semi-automatically

Manually

The new Chambersburg Forming Drop meets the demand for an accurate, high production hammer for coining, embossing, forming and cold striking. The impact blow, which minimizes springback, can be precisely adjusted to suit particular job requirements.

A Chambersburg representative will be glad to show you a film depicting this new production method. Phone or write for further details.

Chambersburg Engineering Company — Chambersburg, Pa.

CHAMBERSBURG

• The Hammer Builders •

DESIGNERS AND MANUFACTURERS OF THE IMPACTER

When it's a vital part, design it to be FORGED

Free Literature

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mersed and reservoir is provided to promote long life and minimum maintenance, with low electrical resistance for handling large electrical currents required in this type of welding.

18 HIGH-TEMP GAS CARBURIZING—*Surface Combustion Division, Midland-Ross Corp, 2375 Dorr St, Toledo 1, Ohio.* Heat Treat Review, Vol II, No. 2, contains 4-page discussion of newest developments and present status of process. Article is illustrated with numerous heating curves, test sample photomicrographs and photos of typical high-temperature carburizing equipment.

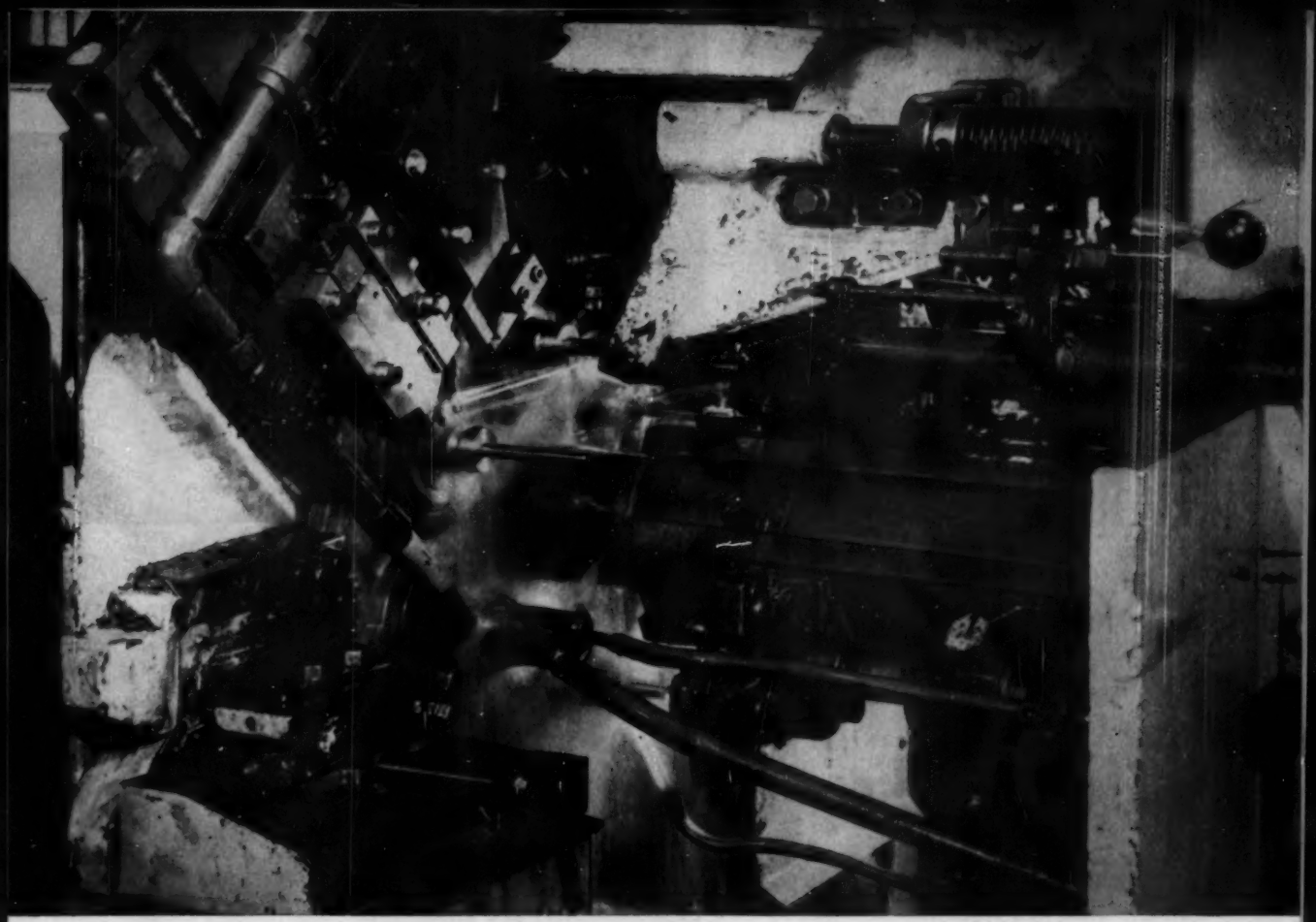
PLANT SERVICE EQUIPMENT

19 METAL CHIP HANDLING SYSTEMS — *Link-Belt Co, Prudential Plaza, Chicago 1, Ill.* 12-page book 2926 covers systems for automatic continuous crushing and de-oiling of metal chips and turnings; systems are reported to recover better than 95% of cutting oil and produce crushed chips. Includes photos and diagrams of custom-engineered systems for both large and small plant operations that require mass matching of ferrous or non-ferrous parts.

20 DC CONTACTORS AND RELAYS—*General Electric Co, Schenectady 5, NY.* 32-page bulletin GEA-6621A describes new GE design approach permitting customer to reduce inventory by assembling building-block components. Includes illustrations, layout and schematic diagrams, application data, and specifications for each line of general-purpose contactors (25-100 amp), mill-type contactors (100-2500 amp), time-delay contactors, general-purpose and timing relays, instantaneous-overload and thermal-overload relays, field-loss relays, field accelerating and decelerating relays, and high drop-out relays.

21 STEEL SHELVING—*Alan Wood Steel Co, Penco Division, 200 Brower Ave, Oaks, Pa.* 36-page catalog 2400 describes and illustrates complete line including boltless T-line and angle shelving, tool storage inserts, drawer case units, bin units, custom shelving arrangements, and truck shelving. Section included on steel lockers, storage cabinets, and bookcase shelving. Specifications, dimensions, capacities listed.

"He never lets yuh forget!"



TOUGH, ON-THE-JOB TESTS LIKE THESE CONVINCE USERS

Texaco Cleartex Performs Better

ON BOTH CUTTING AND LUBE SIDES!

Company A: a leading bearing manufacturer (name on request).

Job: forming and cut-off of 52100 and C-1118 tube stock for bearing races.

Had been using: three petroleum products; one on lube side, one on cutting side, one to build up cutting oil diluted by lube oil.

TEST: Texaco Lube Engineer recommended dual-purpose Cleartex 140 for *both* cutting and lube sides of 2⅝" Conamatic for thirty day trial.

RESULTS: better finish, improved tool life, no dilution of cutting oil. Company switched *all 30 automatics* to Cleartex. After 6 months, no addition of base oil needed!

Company B: a well-known maker of cable (name on request).

Job: machining 303 Stainless brake cable nipple.

Had been using: three products—lube oil, cutting oil and base oil.

TEST: Texaco Lube Engineer recommended Cleartex 140 for *both* cutting and lube sides of 1⅝" six spindle Greenlee.

RESULTS: after two weeks, company began gradual switch-over of *all 22 automatics* to Cleartex! Got better tool life, improved finish on wide variety of steels, stainless and brass! Six months later—no compounding needed, even after tapping tough stainless!

A Texaco Lubrication Engineer will help you select the Cleartex grade which can give you similar results on your automatics. Just call the nearest of the more than 2,300 Texaco Distributing Plants, or write:

Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

TEXACO

Throughout the United States

Canada • Latin America • West Africa

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

CIRCLE 284 READER SERVICE CARD

VERSATILITY

the extra value you get with

WT ALKER-TURNER

20″ drill presses

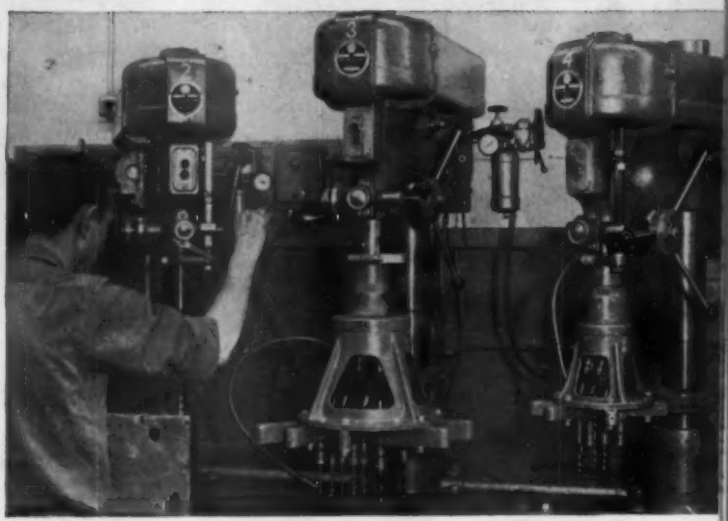
You want the most efficient set-up for every job —*now* and when your production requirements change. That's where Walker-Turner "Light Heavyweight" 20″ drill presses can really pay off. These fast, rugged, accurate tools cost far less than many single-purpose machines—yet can do the same work when used as components in standard or semi-automated set-ups. They can be adapted, quickly and economically, to handle *hundreds* of applications. Built to withstand years of heavy duty wear, W-T drill presses offer lower maintenance costs, save you money in reduced operating expenses.

Your Walker-Turner Distributor (listed under "TOOLS" or "MACHINE TOOLS" in the Yellow Pages) is thoroughly familiar with all phases of metalworking. He'll gladly show you the full line of Walker-Turner 20″, 17″, 15″ and new 14″ Hi-Speed drill presses—in floor, bench and single or multiple-spindle models. See him soon for money-saving ideas and tools.

For **FREE CATALOG** of the complete line of W-T metalworking tools, write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WG-21 400 N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ont.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

2 Spindles—drilling and tapping



3 Spindles—multiple hole drilling (2 speeds)

24 Spindles—sequence operations

CIRCLE 285 READER SERVICE CARD

Cincinnati Milling Machine Co has appointed **Maurice Gormly** manager of the Products Division to succeed **Philip O Geier Jr,** now vice president and assistant general manager. Mr Gormly was formerly director of the Grinding Wheel Laboratory and manager of the grinding wheel plant

Pratt & Whitney Co, West Hartford, Conn, has named **Gordon W Smithson** chief engineer. He was vice president and chief engineer of Potter & Johnston Co which was integrated with Pratt & Whitney in 1959

Heald Machine Co, Worcester, Mass, has named **Charles N Hall** chief grinding engineer. Formerly field sales engineer at the Detroit branch office, he succeeds **Clifford G Menard,** appointed consulting engineer for the engineering and research departments

NAMES IN THE NEWS...

Gleason Works, Rochester, NY, has announced that **Raymond W Doell,** vice president, will assume overall administration of engineering activities as chief engineer. **John Somerset,** associated with the company for 23 years, has been named sales manager.

Timken Roller Bearing Co, Canton, Ohio, has named **H J Urbach** director of engineering. He has been executive engineer since 1951. **Ralph E McKelvey,** formerly assistant chief engineer of the Physical Laboratories, has been promoted to assistant director of engineering.

Ford Motor Co's Aeronutronic Division, Newport Beach, Calif, has named **Dr Ernst H Krause** head of Electronic Systems Operations (formerly Range Systems Operations). He has been general operations manager of the Division's Computer Operations and Range Systems Operations. **Dr S Dean Wanlass,** formerly manager of marketing on the Division staff, has been appointed general operations manager of Computer Products Operations.

Gregory Industries Inc, Lorain, Ohio, manufacturer of Nelson stud welding, stud driver, and Bulldog fastening products, has appointed **Harold A Hallstein Jr** general field sales manager. Mr Hallstein joined the Nelson Stud Welding organization in 1946 and has been a Gregory Industries' product sales manager for the past two years.

Norton Co, Worcester, Mass, has announced the retirement of **Andrew B Holmstrom** as vice president. He has been associated with the firm for 41 years and has been a vice president since 1944.

General Motors Corp has appointed **Kenneth N Scott** general manager of the Buick-Oldsmobile-Pontiac Assembly Division. Formerly manager of the B-O-P plant at South Gate, Calif, he succeeds **James L Conlon** who has retired.

Dana Corp, Toledo, has appointed **Joseph E Starich** general manager of its wholly owned subsidiary, **General Drop Forge Corp,** Buffalo. He moves up from the post of general superintendent there. **O L Glauque** has been named plant manager of Dana's Auburn, Ind, Division. Formerly plant superintendent at Auburn, he succeeds **Rene C McPherson,** recently named executive vice president of Dana's Canadian subsidiary, Hayes Steel Products Ltd, Merritton, Ont.

Warner Electric Brake & Clutch Co, Beloit, Wis, has appointed **Jack H deKruif** vice president of marketing and sales. He was formerly a member of the corporate marketing staff of Hughes Aircraft in Los Angeles.

Indiana Forge & Machine Co, East Chicago, Ind, manufacturer of die forgings, has promoted **James W Brown** to the post of sales manager. He was previously Chicago district sales representative.

Alloy Casting Institute has elected **J D Hagans** president for 1960-61. Mr Hagans is sales manager of **Ohio Steel Foundry Co,** Springfield, Ohio.

Hitemp Wires Inc, Westbury, NY, has appointed **Francis X Buschman** director of research, development, and engineering. Prior to joining the company Mr Buschman was vice president in charge of operations for Tensolite Insulated Wire Co.

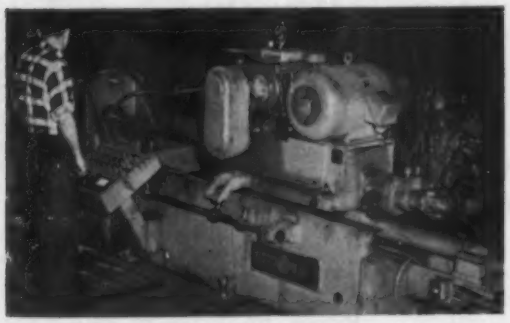
Pacific Moulded Products Co, Los Angeles, has named **Norman A Klemp** plant manager. Before joining the company Mr Klemp was assistant to the president, Sheller Mfg Corp, Detroit. **Robert S Lundgren,** formerly manager of engineering and development of the Mechanical Goods Division of General Tire & Rubber Co, has joined Pacific as chief engineer.

Minneapolis-Honeywell Regulator Co has appointed **William B Shellenberger** manager of the newly created planning and procurement department at the Brown Instruments Division. Mr Shellenberger will continue to serve as consultant to the six-division Industrial Products Group on production planning and procurement.

Ex-Cell-O Corp has appointed **Edwin P Nelson** district manager of the New York-Philadelphia area office in Springfield, NJ. Formerly in charge of the Milwaukee sales office, he replaces **William Thompson** who has resigned.

WHY MICROHONING* OF HARDENED LINERS cuts production time two-thirds

One of the largest steel corporations utilizes Microhoning's rapid stock-removal in the processing of oil well slush pump liners. Bore diameters ranging from 4.50″ to 7.75″ and up to 28″ long are lined with a special alloy steel hardened to 64-66 Rockwell "C". Over one cubic inch of stock per minute is removed from bores of these liners to reduce required production time by two-thirds.



This heavy-duty Hydrohoner has a 4-foot hydraulic head stroke, an 8-speed transmission, a special heavy-duty feed mechanism and automatic stonewear compensation.

One heavy-duty horizontal Hydrohoner has eliminated the use of bore grinding (two grinders), and replaced two old vertical honing machines. Requiring only one operator, the Hydrohoner does the complete bore machining operation in one-third the previous time. Also, during the automatic rough-Microhoning cycle, the operator is free for an average of 20 minutes to work on an adjacent machine, where the liner O.D. is machined concentric to the Microhoned bore.

Two Microhoning operations are performed (rough and finish) to provide final bore roundness and straightness within .0005″ and surface finish of 6-8 microinches (rms). An extremely hard surface having geometric accuracy and controlled finish lasts longer, provides better performance – that's why Microhoning is specified for processing these oil well slush pump liners.

Shown are rough-Microhoned and finish-Microhoned bores. Following each Microhoning operation every bore is given a close inspection under the revealing probe of a fluorescent light to insure a flawless surface.

See facing page for details on how Microhoning of pump liner bores secured production time savings.

**Registered U.S. Pat. Off.*

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NAMES IN THE NEWS...

SKF Industries Inc, Philadelphia, has named **Peter S Given** to the newly created post of manager, airborne products. He will continue as assistant chief engineer of the firm.

Aerospace Industries Association has named **Theodore Grant** western office manager. Mr Grant, who has served with the AIA and a predecessor organization since 1943, succeeds **Captain Leland D Webb** USN (Ret), vice president and western office manager in Los Angeles for 13 years, who has retired.

Mechanical Specialties Co, Los Angeles, has promoted **Michael J Fink** from chief engineer to vice president of the engineering department.

Richard D Brew & Co, Concord, NH, has appointed **William P Carpenter** to the new post of sales manager of the Vacuum Furnace Division. Prior to joining the company Mr Carpenter was manager of subcontract sales for Chandler Evans Corp in West Hartford, Conn.

Sun Oil Co has named **William A Romeiser** general manager of its industrial products department with headquarters at the firm's Philadelphia general offices. He succeeds **Francis F Palmer,** now retail sales manager in the Ohio Valley sales region.

Stromberg Carlson Division, General Dynamics Corp, has appointed **Joseph E Bennett** manager of Digimatic marketing.

Stewart-Warner Corp, Chicago, has named **Arthur Kellermann** manager of manufacturing of the Alemite and Instrument Division. He was previously plant superintendent.

Veet Industries, East Detroit, has appointed **William A Cant** factory sales and purchasing manager. He was formerly sales coordinator of Metal Mouldings Corp.

Latrobe Steel Co, Latrobe, Pa, has elected **J E Workman** president. Formerly executive vice president, he succeeds **M W Saxman** who will continue as board chairman.

Convair Division of General Dynamics Corp has named **Robert C Loomis** vice president and manager of the San Diego operating division. Formerly assistant manager at Convair Pomona, he succeeds **B F Coggan**

who has been named to the newly created post of vice president, special projects, in the general office.

Yale & Towne Manufacturing Co has appointed **John J Gell** assistant general manager of the Lock and Hardware Division, White Plains, N.Y. He has been serving on the staff of the general manager of manufacturing at the division for the past three years.

Wyle Manufacturing Corp, El Segundo, Calif, has named **Curtis M Lee** chief engineer. Prior to joining the company he was associated with Rheem Manufacturing Co as assistant manager of new product research and development.

Colvin Laboratories Inc, East Orange, NJ, has appointed **Lewis M Duckor** vice president, engineering. Before joining Colvin Mr Duckor was associated with Lockheed Missiles and Space Division as senior research engineer in instrumentation.

American Society of Tool and Manufacturing Engineers, Detroit, has named **Col Leslie Fletcher** director of the Society's Standards activity and staff administrator to the committee handling projects in that area. He will continue as director of the Society's research fund.

Howe Sound Co, New York, has appointed **Boyd Cass** general manager, metals/refractories. Mr Cass will be responsible for the Metals/Refractories Group which includes WaiMet Alloys Co, Dearborn, Mich, and Frank Samuels & Co, Philadelphia. Prior to joining Howe Sound Mr Cass was sales manager of Foote Mineral Co.

Thomas C Wilson Inc, Long Island City, NY, manufacturer of tube cleaners and expanders, and portable pneumatic production tools, has elected **O J Bagnoli** president to succeed **Mrs Martha A Wilson,** named board chairman. **Alexander John,** formerly sales manager and assistant general manager, succeeds Mr Bagnoli as vice president.

OBITUARIES

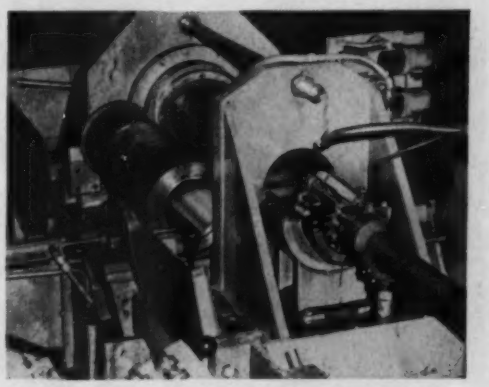
Hesslar T Gates, former vice president and factory manager of Fellows Gear Shaper Co, Springfield, Vt, died June 27 at his home in Charlestown, NH. Mr Gates retired from the company in 1956.

William H Roberts, 42, executive vice president of **Detroit Stamping Co,** died June 21. He was a son of the founder of the firm, William Herbert Roberts.

HOW MICROHONING OF HARDENED LINERS cuts production time two-thirds

Microhoning eliminates bore grinding (two grinders), replaces two old vertical honing machines with one horizontal Hydrohoner, and performs all bore machining on this one Hydrohoner in one-third of the previous processing time. Here's how these unusual production results are obtained on oil well slush pump liners.

Two Microhoning operations (rough and finish) are performed on the bores of these hardened (64-66 Rockwell "C") liners. Bore diameters range from 4.50" to 7.75" and lengths are up to 28". The rough Microhoning removes approximately .090" of stock at an average clip of .0045" per minute and generates a 20 microinch (rms) finish.



Fixturing includes hydraulic end clamping to handle liners from 14" to 28" long. Adjustable hydraulic loader handles varying diameters. Heavy-duty Micromold tooling allows the use of more abrasive for faster stock removal. One tool handles a range of bore diameters.

A new stonefeed assembly, capable of exerting a five-ton thrust, permits this stock-removal performance. When the Microhoning tool enters the bore, the abrasives are instantly expanded against the bore surface. As contact is made, a sensing device de-energizes the rapid feed and a pre-set regular feed rate controls further expansion. At the end of the automatically timed Microhoning cycle, the tool is instantly collapsed and withdraws from the bore.

Changeover from rough to finish Microhoning requires only the replacing of abrasives with finer-grit sticks and resetting of timer to shorter cycle—less than 90 seconds is needed for changeover. Finish Microhoning time is about two minutes, roundness and straightness are held within .0005" variation throughout the length of bore, and surface finish of 6-8 microinches (rms) is generated.

MMT-PE

Visit Us In Booth 1225 — The Machine Tool Exposition

MICROMATIC HONE CORP.
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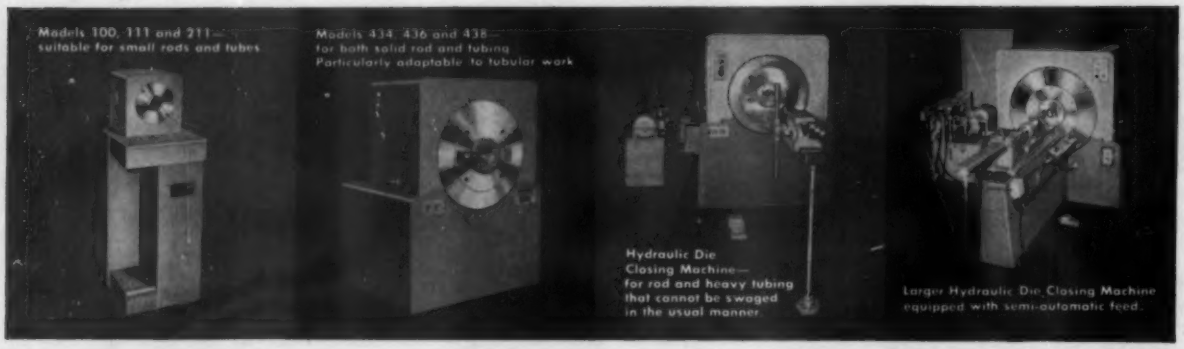

Models 100, 111 and 211—
suitable for small rods and tubes
Models 434, 436 and 438—
for both solid rod and tubing.
Particularly adaptable to tubular work
Hydraulic Die
Closing Machine—
for rod and heavy tubing
that cannot be swaged
in the usual manner.
Larger Hydraulic Die Closing Machine
equipped with semi-automatic feed.

TORRINGTON ROTARY SWAGING MACHINES DO JOBS LIKE THIS FASTER AT LOWER COST

Swaging is not only the fastest but also the most economical way to point, taper, reduce, size or bond thousands of small metal parts. You save on time, labor and materials—no stock is wasted. Tooling is simple and inexpensive.

Consider the variety of swaged metal parts illustrated here. If you are producing such parts by other means, you are probably paying too much for them – and not getting the improved metal grain structure and surface hardness and finish that swaging provides.

Torrington is the top authority on swaging. We originated the process and designed the original equipment. We offer you more swaging experience than any other company in the world. If a part can be swaged, we have the skill and knowledge to produce the dies to swage it. We maintain experimental shops especially to work out your problems. For full information, call in The Torrington Company, Swaging Machine Division, 200 North Street, Torrington, Conn.

progress through precision **ROTARY SWAGING MACHINES**

THE TORRINGTON COMPANY Torrington, Conn.

It's WHAT YOU DON'T SEE that counts!

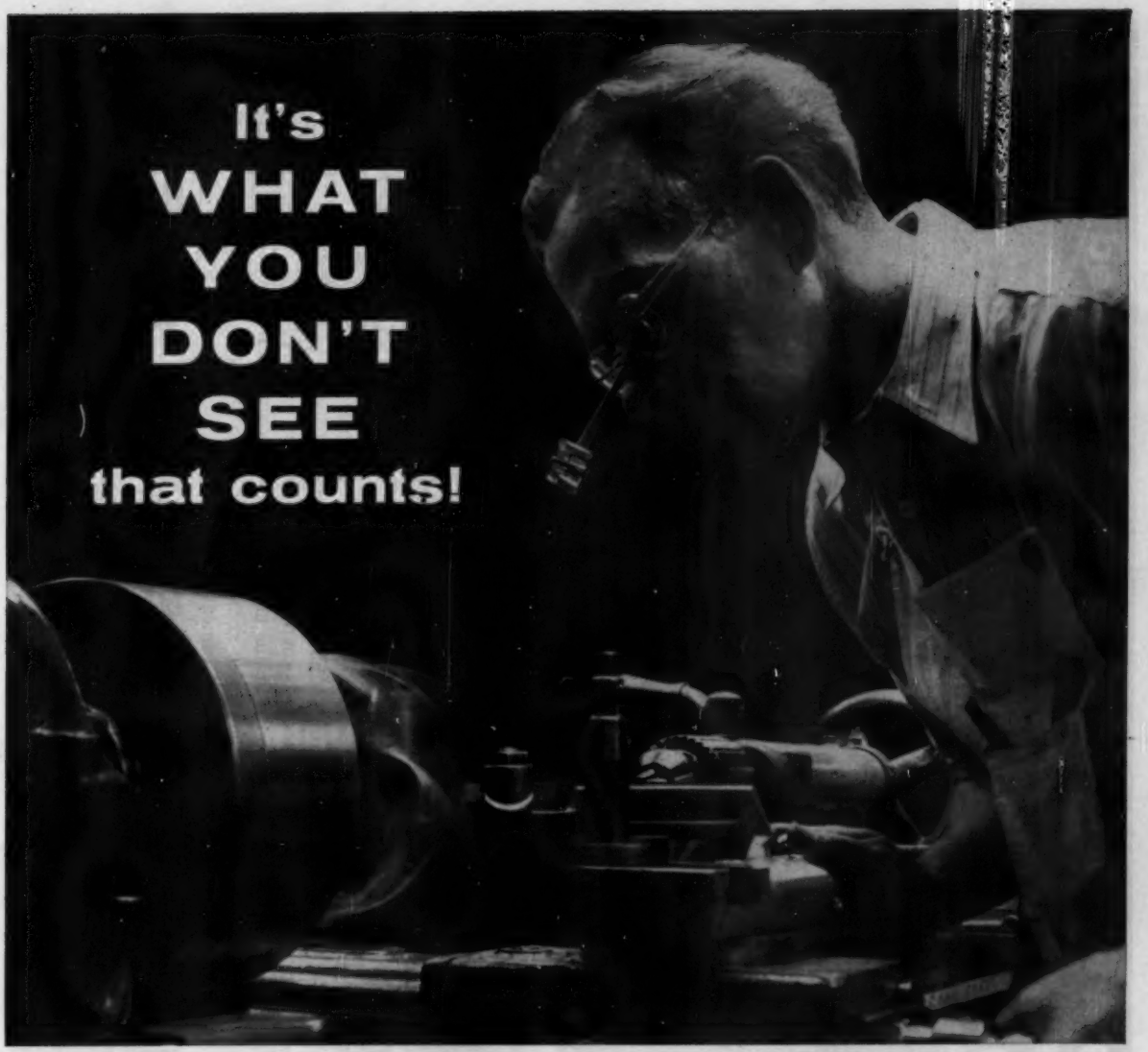


Photo from LEARCAL DIVISION, LEAR INC., Los Angeles

Quality control and production records can quickly prove the efficiency of South Bend 16" Lathes. What you can't see is their *dependability* that assures low cost precision machining for years to come. They can do it because of such features as—

- Integrity of manufacture—honest workmanship using the finest materials.
- Spindle bearings designed specifically for precision work—microfinished sleeve type for close tolerance, *fine finish* work.
- Built to take it for *proven* low maintenance.
- Trouble-free belt drive to the spindle—quiet, no vibration, no gear marks.
- *Write for catalog of South Bend Lathes, milling machines, shapers, drill presses and pedestal grinders.*

Specifications	16" Lathes
Collet capacity	1 1/16"
Spindle speeds	15 to 980 r.p.m.
Cross and longitudinal feeds	48
Threading feeds	48
Base price	$2591

Up to 36 months to pay

SOUTH BEND LATHE

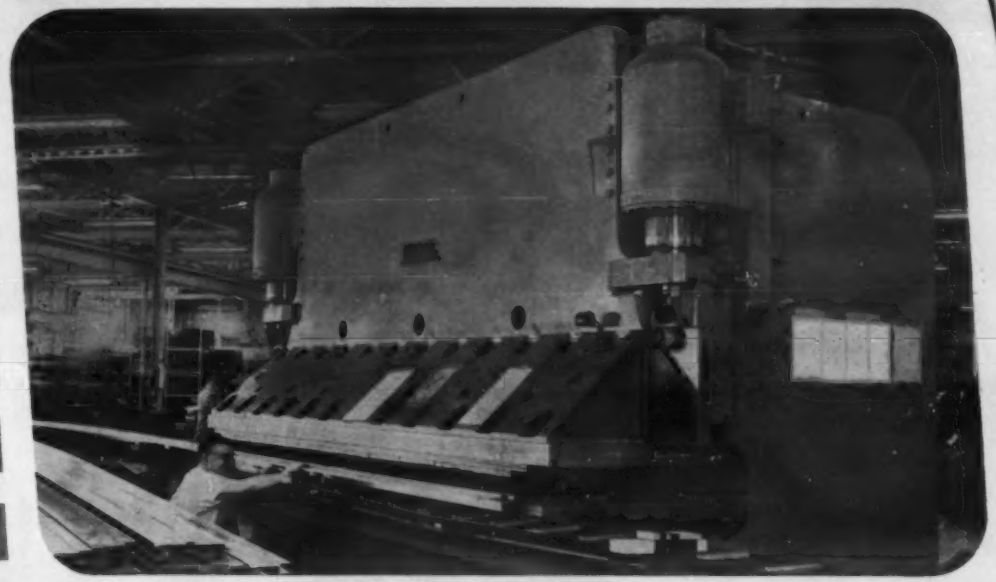
South Bend 22, Indiana

Building Better Tools Since 1906

15 years engineering and millions of dollars invested* to perfect the world's finest brake... today's PACIFIC HYDRAULIC PRESS BRAKE

Over 9 out of every 10 hydraulic press brakes in operation today are PACIFIC providing...

- More dependability
- Freedom of maintenance and leakage
- Simpler electric controls
- Simpler hydraulic control
- More accuracy in level control
- More accuracy in air bending
- More operating convenience
- Greater visability
- More rigidity in cylinder construction
- Shock-free hydraulic system suitable for punching



672 HOLES PUNCHED IN A SINGLE HIT! Unique upper ram guides and extra rigidity of platens of PACIFIC hydraulic press brake enable the punching of 672 holes in a single hit over a 45" wide by 14 ft. long side panel at Brown Trailer Division, Michigan City, Indiana. This rigidity permits 40 ft. long rub rails to be punched progressively with 70 holes on 2" centers over 12 ft. length on the front of the die as shown in the above photo. Cushioned hydraulic breakthrough softens the punching action on the dies to greatly increase individual punch life and eliminate costly downtime from periodic die replacement of 672 separate dies.

*THIS INVESTMENT ENABLED PACIFIC TO INTRODUCE:

- Tape control to synchronize cylinders within .003" (1947)
- Cushioned punching (1949)
- Precision depth control to repeat accuracy within .001" (1951)
- Manual turret stroke controls for progressive bending (1952)
- Selective anti-whip speeds to eliminate reverse bends (1952)
- Tandem operation of press brakes for forming pieces 40 ft. or longer (1953)
- Tonnage control to protect light dies in heavy press (1953)
- Multiple hydraulic cushion cylinders for deep drawing (1954)
- Overhead integral power unit for increased accuracy (1955)
- Cylinder ram guides for increased rigidity (1956)
- Shearing attachment for shearing heavy plate on press brake (1958)
- Pipeless stacking of valves to eliminate pipe breakage and leakage (1959)
- Shockless hydraulic valving to eliminate cause of leakage (1959)

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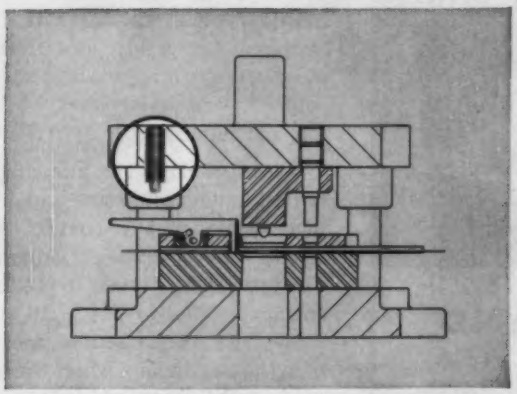
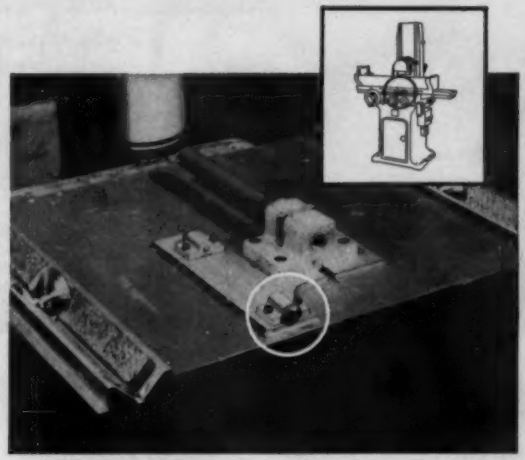
Practical Tooling Tips

Number 2 of a series.

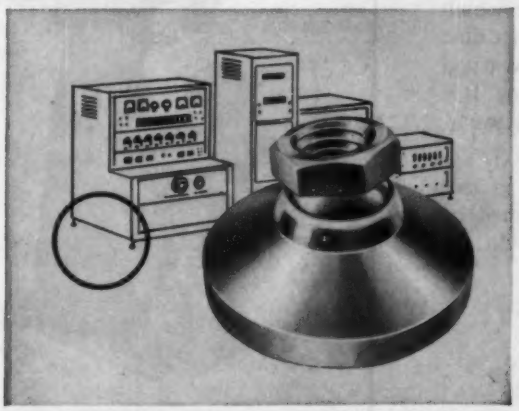
Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.



TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the *standard* Vlier leveling pad. The pad swivels to 7½° each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

TO GET NEW IDEAS on how to save with Vlier Tooling Accessories, send for new 28-page booklet "Typical Applications of Vlier Tooling Accessories." It suggests dozens of ways to use these time-savers in both tooling and original equipment applications. Write for your copy today.

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Insist on Vlier Tooling Accessories... there's still no substitute for quality!

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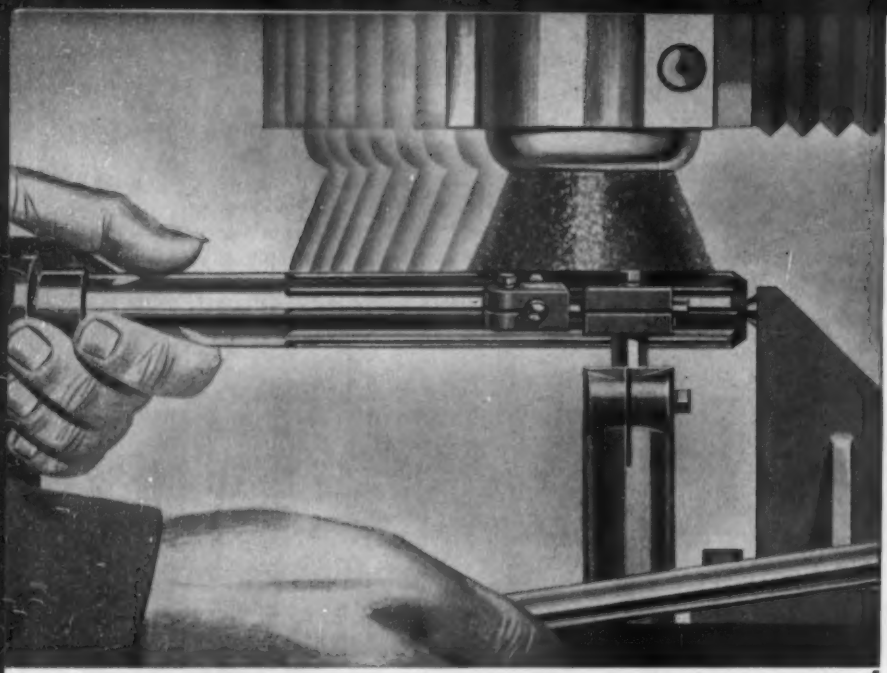

OLIVER "ACE" TOOL AND CUTTER GRINDER

Traverses the wheel—not the work!

You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought to the work, reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head is fully enclosed—sealed against dust and dirt. Further accuracy is assured because the wheel is trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

The "ACE" is a tool and cutter grinder designed expressly for tool grinding—not a general purpose machine adapted to tool room work. It is simple to set up. All angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.

Face mills, reamers, end mills, staggered tooth cutters, slab mills, spot facers—all cutters straight or spiral—are quickly, easily and economically sharpened with the Oliver "ACE". Both standard and heavy duty models are extensively used for sharpening carbide-tipped circular wood saws used in both woodworking and metalworking.

Write today for complete information. We'd appreciate the opportunity of sending a quotation.

OLIVER of ADRIAN

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(Advertisement)

HOW TO REDUCE YOUR CUTTING TOOL COSTS

Three elements are absolutely necessary if there is to be a substantial reduction in cutting tool costs—the right tool, the right geometry of grind on that tool, and the right machine to produce the grind. There are various machines which will always be most suitable for specific applications. However, for the average cutter grinder jobs, Oliver has pioneered a new approach to the problem with the introduction of the "ACE" tool and cutter grinder.

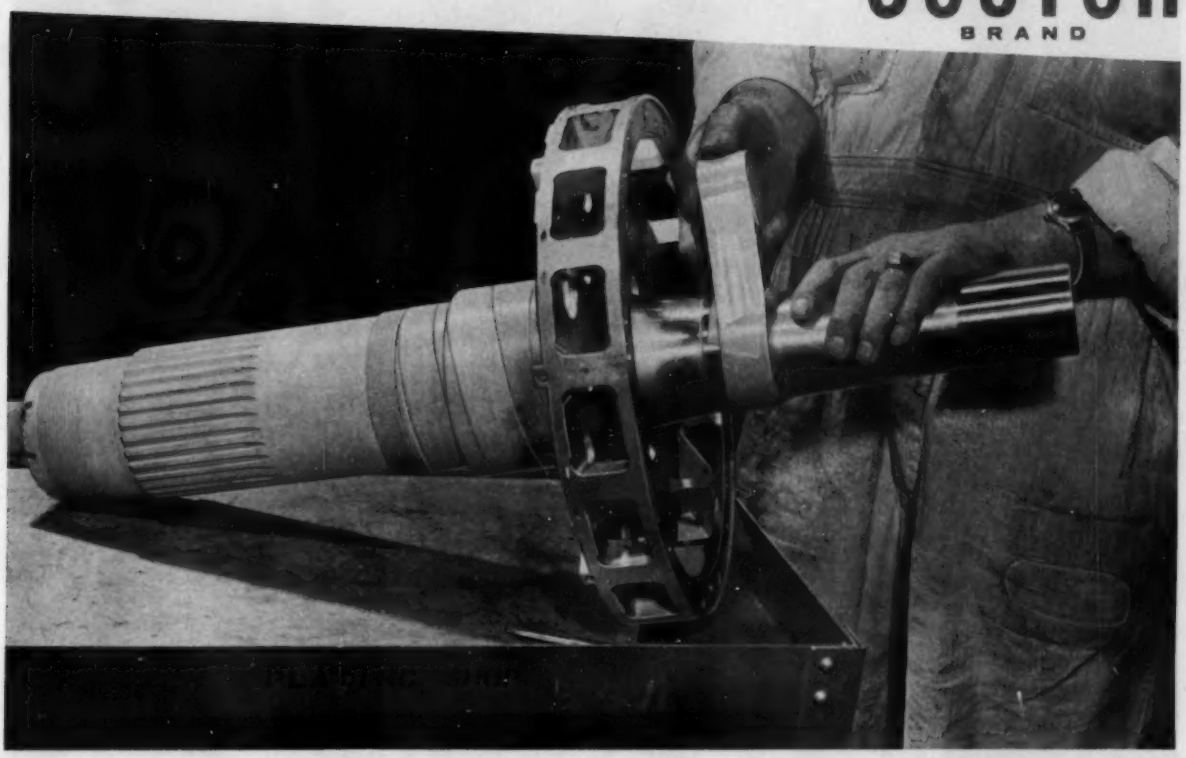
The cost savings are attractive with respect to both setup time and grinding time. Setup usually consists of two simple "direct-reading" adjustments. The first setting is made to produce the angular or straight line grind requirement. The second setting consists of tilting the grinding wheel spindle to produce the proper clearance—all extremely simple.

The Heavy Duty "ACE"

Grinding time is reduced considerably because tool travel is eliminated in most cases. Thus the time consists wholly of bringing the grinding wheel on and off the cutting tool. This compares extremely favorably with competitive grinding procedures.

There are two versions of the "ACE": the standard, which is suitable for high speed and light duty carbide grinding, and the heavy duty model which is designed for grinding tungsten carbide cutters and tools in all of their many forms.

SCOTCH
BRAND



TAPEnology... industry's newest cost-cutting tool

Tape masks off difficult areas easily ...for positive plating protection

Speed up and simplify your plating operations with "SCOTCH" BRAND Plastic Tape No. 470. Sticks at a touch. Conforms to most shapes. Safely seals off areas not to be plated and eliminates "creeping under" action. Results in clean, sharp-line plating.

"SCOTCH" Plastic Tape No. 470 ends costly machining time needed to reduce excess build-up that often results when other masking agents are used. 470's tough vinyl plastic backing withstands the effects of acids, alkaline solutions, most hydrocarbons, and other solvents used in plating operations.

What's your plating problem? Chances are your nearest "SCOTCH" BRAND Tape Distributor can solve it for you. Ask him, or write: 3M Co., 900 Bush Avenue, St. Paul 6, Minn.

When tape costs so little, why take less than "SCOTCH" Brand?

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN.
EXPORT: 99 PARK AVE., NEW YORK 16. CANADA: LONDON, ONTARIO.

MINNESOTA MINING AND MANUFACTURING COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW

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CIRCLE 294 READER SERVICE CARD

OK, OK... SO YOU HAVE A GREAT STORY TO TELL ABOUT AUTOMATION - SO WHAT'S THE PUNCH LINE?

Story is this: If you use impact tools* in your operation . . . if you have the remotest suspicion there might be a better, faster, cheaper way of doing it (automation, for instance?) . . . cheer up. You are probably right. Here's how to find out for sure. Ask Black & Webster. They make all-electric impact hammers (Electropunch). Equal anything you've ever seen for speed and precision. Beat anything you've ever seen for operating economy. Through unique B & W custom engineering service, Electropunches can be combined with special, high precision indexing tables (Electrotable), vibratory feeders (Electrofeed), necessary tooling. Whole system tailored to your needs. Automatized. Your costs cut. Production up. Has happened to many others. Can happen to you. Ask.

BLACK & WEBSTER, INC. Dept. 3, 570 Pleasant St., Watertown 72, Mass.
PHONE: WALNUT 6-0100

*For staking, swaging, riveting, punching, marking, etc.

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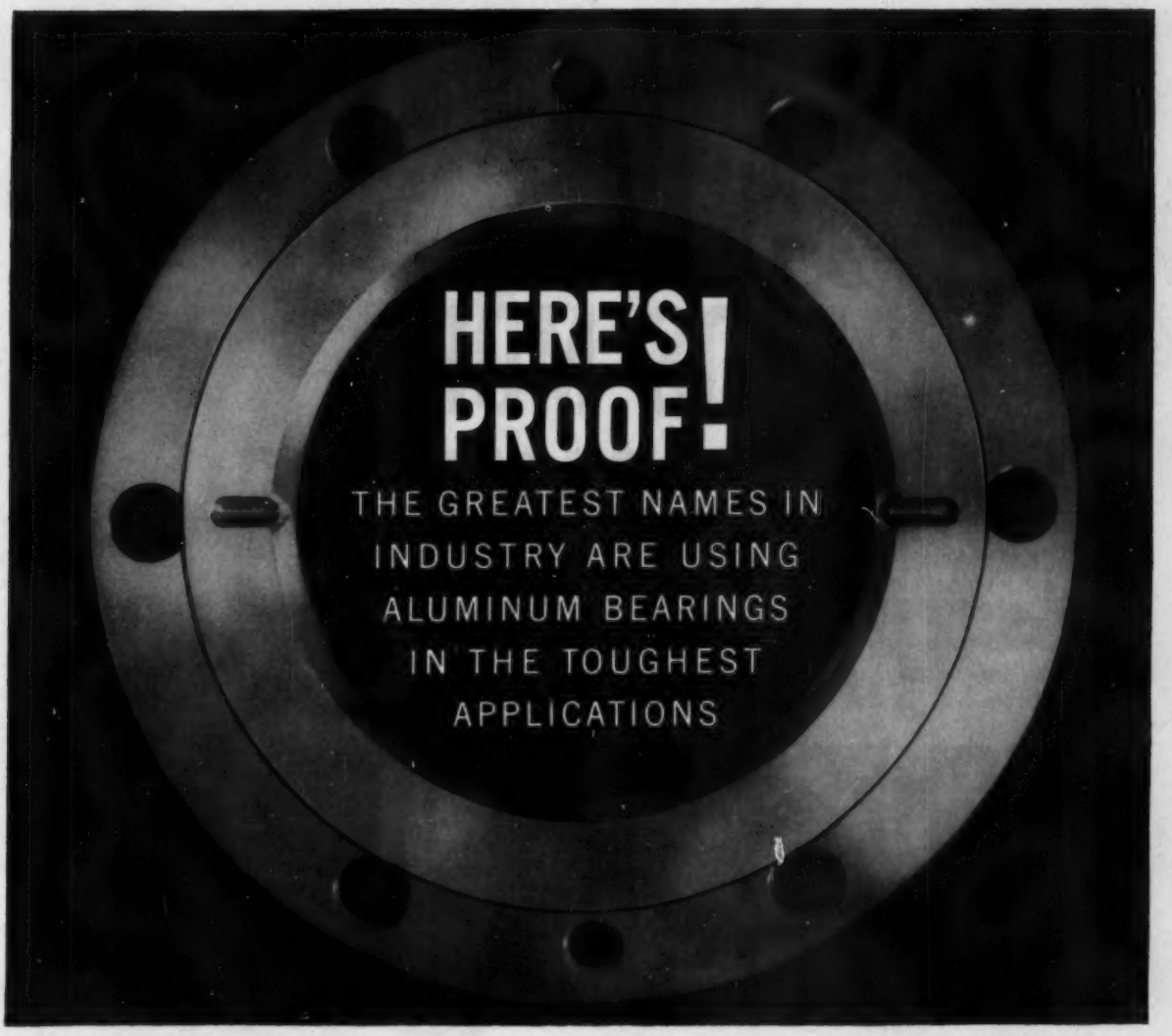
ELECTROPUNCHES — All-electric impact hammers for high-speed production. Up to 300 blows per minute. Up to 5-ton impact.

ELECTROTABLES — highly accurate, all-electric, Geneva action indexing tables. Combined with Electropunches, vibratory feeders or other tools, they approach the ultimate in automation.

CUSTOM ENGINEERING — A special engineering service for special assembly problems. B & W tailors a complete system to your requirements.



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- power shovels
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- rolling mills
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For information on aluminum bearings see your bearing manufacturer, or write Aluminum Company of America, 1839-G Alcoa Building, Pittsburgh 19, Pa. For aluminum bearing stock, see your nearest Bunting Distributor.

World-wide sales through Alcoa International, Inc. 230 Park Avenue, New York 17, N. Y.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

WHAT HAPPENS WHEN A NATION SPENDS MORE ON GAMBLING THAN IT SPENDS FOR HIGHER EDUCATION?

If you can find any Romans around, ask them. They lived pretty high on the hog in their day. That is, until some serious-minded neighbors from up North moved in. The rest is ancient history.

You'd think their fate would have taught us a lesson.

Yet today we Americans spend twenty billion dollars a year for legalized gambling, while we spend a niggardly four-and-a-half billion for higher education. Think of it! Over four times as much! We also spend six-and-a-half billion dollars a year for tobacco, nine billion dollars for alcoholic beverages, and billions more on other non-essentials.

Can't we read the handwriting on the wall?

Our very survival depends on the ability of our colleges and universities to continue to turn out thinking men and women. Yet today many of these fine institutions are hard put to make ends meet. Faculty salaries, generally, are so low that qualified teachers are leaving the campus in alarming numbers for better-paying jobs elsewhere.

In the face of this frightening trend, experts estimate that by 1970 college applications will have doubled.

If we are to keep our place among the leading nations of the world, we must do something about this grim situation before it is too late. The tuition usually paid by a college student covers less than half the actual cost of his education. The balance must somehow be made up by the institution. To meet this deficit even the most heavily endowed colleges and universities have to depend upon the generosity of alumni and public spirited citizens. In other words, they depend upon *you*.

For the sake of our country and our children, won't you do your part? Support the college of your choice *today*. Help it to prepare to meet the challenge of tomorrow. The rewards will be greater than you think.

It's important for you to know what the impending college crisis means to you. Write for a free booklet to HIGHER EDUCATION, Box 36, Times Square Station, New York 36, New York.

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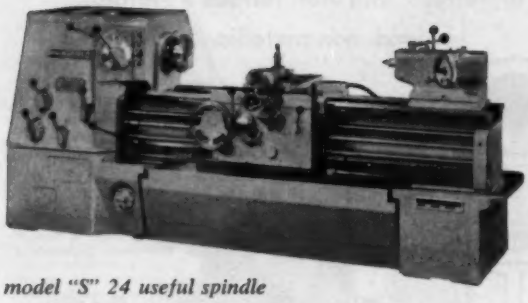
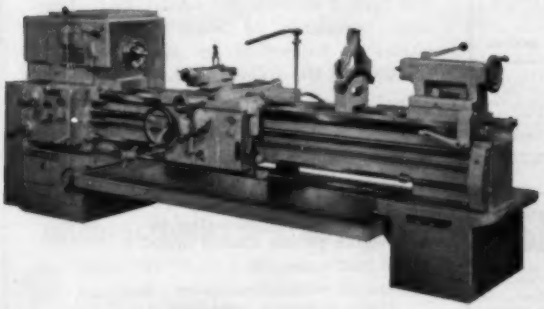


model "S" 24 useful spindle speeds, 66 feeds & threads
heavy duty 16"
medium duty 20"

MMT·PE

new developments coming!



model 280 16 useful spindle speeds, 60 feeds & threads
heavy duty 14", 16"
medium duty 20"

The Springfield Machine Tool Company
Springfield, Ohio

Engine & Toolroom Lathes

Springfield lathes have 10, 15 or 20 horsepower motors for heavy cuts, and have simple, practical features that keep the operator productive and keep the maintenance man away. Pressurized mist lubricates the headstock. Only four gears are in mesh for a given speed—the others run free. Clean, functional design and simplified controls promote pride of workmanship and minimum waste motion.

Ruggedness with precision has always been characteristic of Springfield lathes—because they are built to *one* standard of excellence. A Springfield engine lathe meets the accuracy standards set up for toolroom lathes —without *any* cost penalty.

Whenever you want maximum power and efficiency, and the cost designed out by designing simplicity in, consider a Springfield lathe. A full range of attachments is available—hydraulic contouring and reproducing, plain and universal relieving, taper, etc.

If you would like to know more about Springfield lathes, please write for Bulletins 190-G and 201-G.

SPRINGFIELD

KERNS SCF-3207

SOLUBLE CUTTING FLUID

used on 35 screw machines

at

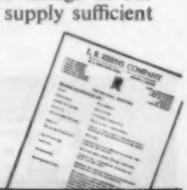
Versatile Kerns SCF-3207 is used as both a lubricant and coolant on 35 automatic screw machines at SKF Industries, Inc. Famous SKF quality rings, rollers and sleeves are turned out on these machines which are supplied by individual coolant systems in which the Kerns SCF-3207 solution is varied with the operation.

RESEACHED 11 YEARS—Kerns SCF-3207 is the result of extensive research and development. It's the greatest advancement in cutting fluids in the last fifty years and is designed to replace cutting oils in up to 90% of all types of machining operations. It can do this because it is a water emulsifiable, heavy duty, cutting oil base containing high percentages of high film strength and anti-weld additives.

CUT COST AND INVENTORY—Kerns SCF-3207 is actually 25% less expensive than the lowest priced straight cutting oils and cuts inventory and warehouse requirements. Only 5 drums of Kerns SCF-3207 equals 50 or more drums of straight cutting oil.

SAFE . . . CLEAN—Absolutely no dermatitis, positively no rancidity. Can be used with absolute safety in any type of machine tool and due to lighter viscosity there is less carry off. Parts are cleaner, cooler, easier to handle.

PROVE IT TO YOURSELF—Take advantage of our Memo Billing Trial Basis Policy. We supply sufficient quantity of SCF-3207 to conduct a comprehensive production run test, no formal invoice rendered unless completely approved in production.



Write for Technical Data Sheet SCF-3207

SEE US AT BOOTH NO. 1511 DURING THE 1960 MACHINE TOOL SHOW, SEPTEMBER 6 THRU 16.

L. R. Kerns Company
2659 EAST 95th STREET · CHICAGO 17, ILLINOIS

Subsidiary Plant **KERNS PACIFIC CORPORATION**
630 N. Batavia Street · Orange, California

FOR High-Speed Cutting

of ferrous and non-ferrous metals...
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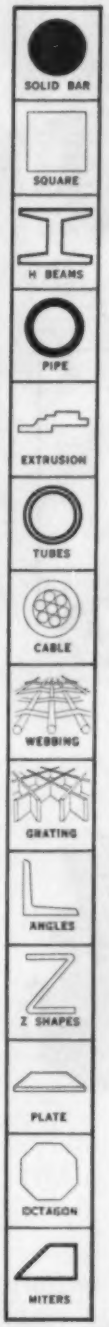

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Used by every major industry throughout the world, Stone machines are famous for *fast, accurate* cutting . . . delivering smooth, mill-like finishes to extremely close tolerances . . . at cutting rates of less than 4 seconds per square inch. The high popularity of Stone cutting machines is supported by such practical features as the following:

- **Geared-in-head motor (a Stone exclusive)**
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- **Self-centering vise**
- **Heavy cast machine surfaced table for jigs and fixtures**
- **Wide range of gear ratios to assure proper spindle speed**
- **Oil mist spray**
- **Manual, semi-automatic or fully automatic operation**
- **Pneumatic power stroke**
- **Choice of 3½ to 15 HP motors**

Stone's Complete Line of Chop-Stroke, Miter and Traverse-Type Machines is fully described in new literature containing latest developments and improvements. SEND FOR IT TODAY!

Stone MACHINERY CO., INC.
MANLIUS, N. Y.
HIGH SPEED CUTTING MACHINERY

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16. Drilling & Reaming Machines
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31. Liquidating & Appraising Plants
32. Machine Tools
36. Milling Machines
43. Press Brakes
44. Presses
51. Saws
53. Shapers
54. Shears
63. Welding Equipment
66. Upsetters

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MANUFACTURER'S SPECIAL!

MOREY 12" Vertical Shapers
Now Selling Price . . . $20,275.

a few machines available with NEW machine guarantee—factory rebuilt.

SPECIAL PRICE .....each $11,950.

PLUS MULTI-MILLION DOLLAR STOCK OF HARD-TO-FIND MACHINE TOOLS

A few examples of machines we carry in stock: 2—7" bar Giddings & Lewis Boring Mills; late type. 120H Gould & Eberhardt Gear Hobber; late type. R6 Pfauter Gear Hobber; 234" dia. 74' Bullard Cutmaster; 3 heads.

Send for MOREY "NEWS"!

MOREY MACHINERY CO., INC.
383 Lafayette St., New York 3, N. Y.
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UPSETTERS

7", & 8" Ajax horiz. upsetting & forging machines. Mfg. 1943, air clutch, excellent cond. Sacrifice for prompt removal.

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POSITION WANTED

German engineer, with university diploma, wants position. Experienced in machine tool design and manufacturing, especially heavy milling and copying milling machines. Aged 30, good knowledge of English. PW-4782, American Machinist.

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Rebuilt Machine Tools
THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY

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17"x75½" LeBlond, m.d.
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HAND MILLERS

Van Norman Hand, m.d., 1947

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No. 00 Cincinnati, rise and fall, 1944
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No. 33H Sundstrand Triplex Rigidmill, m.d.
No. 3A Sundstrand Plain Automatic Rigidmill, m.d.
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THE EASTERN MACHINERY CO
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1-1241 CABLE ADDRESS EMCO

CIRCLE 502 READER SERVICE CARD

Cimco

20" x 90" American Pacemaker Hydraulic Shaft Duplimatic Lathe, new 1950. 27 spindle speeds.

96" x 96" x 20' Cincinnati Hypro Double Housing Planer, 4 heads, pneumatic tool lifters, late.

6'15" column American Holewizard Radial Drill column extended 2', 32 speeds, late.

14' x 12' x 30' Betts Double Housing Planer, 80 HP DC motor, 4 heads, box table, ACTUAL PHOTOGRAPH AVAILABLE.

18" x 40" x 90" centers Norton Type "G" Cylindrical Grinder, two gaps, swing 40 x 28" in gaps, mechanical feed, late type.

22" x 24' centers Monarch Model CM Geared Head Lathe, actual swing 27½", 16 speeds, two Carriages, taper.

45T Giddings & Lewis table type boring mill, table 40 x 48, outer support, late type.

Model 300 Hanchett, 18 x 48" table, complete with magnetic chuck and rectifier, late type.

24" x 72" Sidney G.L. lathe, 16 speeds, Timken bearing, taper attachment.

16" x 48" Thompson Hydraulic Surface Grinder, late type, AC motor.

72" x 72" x 18' Cincinnati Hypro Planer, 4 heads, pneumatic tool lifters, late type.

#2 Cincinnati Tool & Cutter Grinder, new 1948, assortment of tooling.

Cincinnati Machinery COMPANY
3901 Kellogg Ave., Cincinnati 26, Ohio
Phone TRinity 1-0853

CIRCLE 503 READER SERVICE CARD

36" x 17' cc Lehmann Hydrotal Engine Lathe Rapid Traverse new 1944
12" x 24" Thompson surface grinder magnetic chuck M.D.
BSB Natco Multiple Spindle Drill Press.
2½" drivers arranged for 36 spindles with adjustable #4 taper spindles.

VICTOR MACHINERY CO.
137 So. Clinton St., Chicago 6, Ill.

CIRCLE 504 READER SERVICE CARD

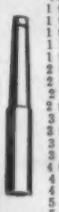
SAVE UP TO 75% ON YOUR TOOL COSTS

STANDARD TYPE DRILL SLEEVES

Morse Taper	Hole	Outside	Used Surplus	New
1 to 2	1	2	.50	1.00
1 to 3	1	3	.65	1.31
1 to 4	1	4	.75	1.56
1 to 5	1	5	1.50	3.89
2 to 3	2	3	.65	1.31
2 to 4	2	4	.75	1.56
2 to 5	2	5	1.75	3.89
3 to 4	3	4	1.00	1.56
3 to 5	3	5	1.75	3.89
4 to 5	4	5	1.95	3.89
4 to 6	4	6	6.50	13.17
5 to 6	5	6	6.50	13.17

ADDITIONAL 5% DISCOUNT ON NEW DRILL SLEEVES WITH ANY ORDER OVER $50.00

STANDARD TYPE DRILL SOCKETS



Morse Taper	Hole	Shank	Used Surplus	Special Price-New
1 to 2	1	2	1.12	2.25
1 to 3	1	3	1.50	2.81
1 to 1	1	1	1.08	1.75
1 to 4	1	4	1.58	3.56
1 to 5	1	5	2.60	5.32
2 to 2	2	2	1.40	2.81
2 to 3	2	3	1.40	2.81
2 to 4	2	4	1.75	3.56
2 to 5	2	5	2.65	5.32
3 to 2	3	2	1.75	3.56
3 to 3	3	3	1.75	3.56
3 to 4	3	4	1.75	3.56
3 to 5	3	5	2.70	5.32
4 to 3	4	3	2.70	5.32
4 to 4	4	4	2.65	5.32
4 to 5	4	5	2.65	5.32
5 to 4	5	4	6.70	13.41
5 to 5	5	5	6.70	13.41
5 to 6	5	6	9.00	16.30

ADDITIONAL 5% DISCOUNT ON NEW DRILL SOCKETS WITH ANY ORDER OVER $50.00

WT FREE BONUS OFFER

YOU GET 1 FREE WHEN YOU BUY 6 CUTTERS MARKED BY ASTERISK BELOW

NEW HIGH SPEED

PLAIN MILLING CUTTERS

Dia.	Width	Arbor	Price	Dia.	Width	Arbor	Price
2¼	1	⅝	4.95	3	2½	1	13.95
2½	1⅛	1	8.50	3	2½	1¼	13.95
2½	⅜	1	12.95	3	3	1¼	15.95
2½	3⅛	1	13.50	3	4	1	17.50*
2½	4	1¼	14.95	3¼	1	1¼	7.95
3	1	1½	6.95	3¼	5	1½	19.50
3	1	1½	8.95	4	2½	1½	17.95
3	1⅛	1½	6.50*	4	3	1¼	24.50
3	1½	1¼	7.95	4	5	1¼	36.50
3	1¾	1¼	8.50	4	6	1¼	54.00
3	2	1¼	8.75*	4	6	1½	39.50*
3	2¼	1¼	10.95	5	1¼	1¼	25.00
3	2½	1¼	12.95				

MINIMUM SAVINGS: 50%

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YOU GET 2 FREE WHEN YOU BUY 6 OF ANY 1 SIZE

NEW HIGH SPEED

BRIDGE REAMERS

Bridge reamers, made of high speed steel, are especially designed for severe service and are particularly adapted for use in structural iron and steel, bridge erection, and ship construction, where frequently extreme precision is not required. The cutting end of the flutes is tapped to permit the reamer to enter overlapping holes often encountered in structural work.

Diam.	Special Price	Diam.	Special Price
25/64	1.00	29/32	1.75
17/32	1.25	1-1/32	2.00
21/32	1.50	1-5/32	3.00
25/32	1.70	1-9/32	3.00

Save 60% on New H.S. Bridge Reamers. The 19/32 Reamer Costs Regularly 28.50. We Sell it for 3.00

ABOVE REAMERS WITH ½" SHANK, ADD 50¢ PER TOOL

SET OF ANY 7 REAMERS ABOVE $11.50

NEW STANDARD STRAIGHT FLUTED

HAND REAMERS

10 PIECE MIX

ONE EACH OF THE FOLLOWING SIZES: 31/64, 1-1/16, 1-7/32, 1-9/32, 1-11/32, 1-15/32, 1-5/8, 1-11/16, 23/32, 1-7/8

NEW COSTS OVER $195

SAVE OVER $180

NEW AT OUR PRICE $9.95

WEIGHT OF SET: 35 LBS.

WHEN ORDERING, WRITE TO DEPARTMENT E

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10248 GRAND RIVER

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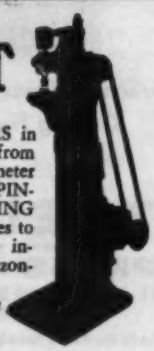

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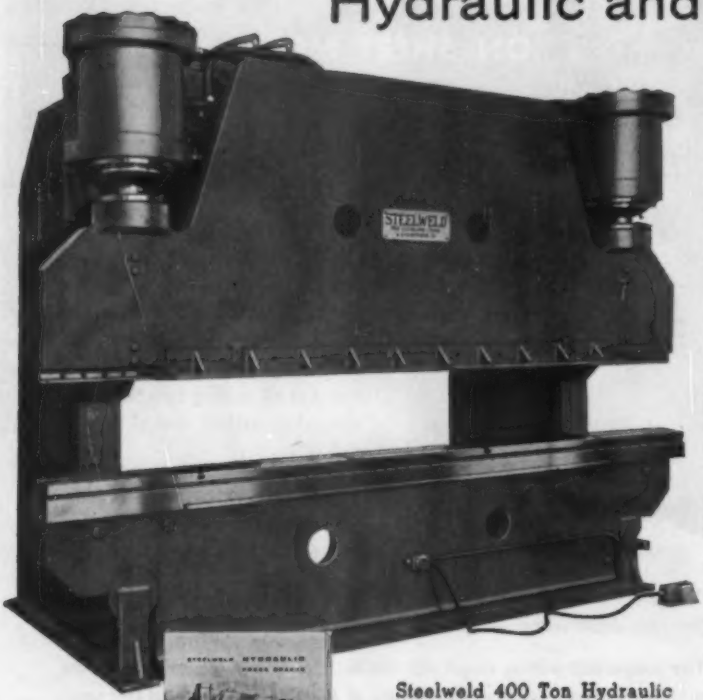

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